THE 1943 YEAR BOOK *of* GENERAL SURGERY

EDITED BY

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PREFACE

One of the regrettable casualties of war is its effect on scientific progress What advance in science occurs is concerned chiefly with attempts to aid the actual conduct of the fighting There is no encouragement to pursue that sort of investigation which will make for better living or better health The more nearly total the war becomes, the more striking will be its inhibiting effect on research that is unconnected with military affairs Now in the fifth year of this total war it is apparent to anyone who reads the current literature that the amazing speed of scientific progress which characterized the last 50 years has been retarded to an appalling degree How long this wave of depression will last cannot be foreseen The editor of the 1943 YEAR BOOK OF SURGERY feels that this brief statement will suffice to explain to the reader why the contents of this volume may appear to be less rich in new ideas than the previous ones There are, however many references to articles dealing directly with various aspects of military surgery

As in the last war, there is general recognition of the importance of debridement of wounds It is to be hoped, however, that many of the mistakes in applying this principle which were made in World War I will not be repeated in this war Debridement should not mean the ruthless sacrifice of living tissue Injured muscle should be split longitudinally to open spaces and fascial planes, but large masses of living muscle should not be needlessly excised As an addition to debridement in preventing serious wound infection great hopes were held that the application of one of the sulfonamides to the wounds would be very beneficial The careful study, however of the ability of these drugs to prevent infection which was made under the auspices of the National Research Council by the Subcommittee on Surgical

Infections has cast considerable doubt on their efficacy in this regard An abstract of the report of the sub committee which was given by its chairman, Frank L Meleney appears in the text In this connection, the article by Sutliff, Helpern, Griffin and Brown is of special interest These authors report that in 1941, sulfonamide toxicity was given as the cause of death in 28 cases in New York City

Plasma as was to be expected, has been found to be very useful, but every surgeon knows that in cases of severe hemorrhage it is whole blood that is needed rather than merely plasma Difficulties of transporting and of refrigerating whole blood in areas of active combat are great Ogilvie, the chief surgical consultant of the British Eighth Army, states that the extensive use of blood from universal donors did much to obviate the difficulties just mentioned The donors were sometimes members of the medical corps, sometimes civilians and at other times soldiers in various branches of the non combat services Plasma of course, still is of great im portance in treating the shock associated with severe burns In this connection, it is interesting to note how the pendulum has been swinging away from the use of tannic acid in burns, despite the fact that a few years ago it seemed to many that this form of treatment was here to stay

The enthusiastic reports of the value of roentgen therapy in the treatment of gas gangrene which have appeared in recent years will perhaps be less justified in the light of Caldwell's experimental study He found that the x rays had practically no effect in retarding the development of gas gangrene in guinea pigs, al though the local application of zinc peroxide had a definite inhibiting effect

As in the last war, cases of wound infections with the diphtheria bacillus have been turning up occasionally It is important of course, that they should be recog nized

Refrigeration anesthesia for operations on the limbs has been proposed by Frederick Allen Several reports of the experiences of other authors are presented in this volume The work of Brooks and Duncan, reported in the 1942 YEAR BOOK (p 130), should be read in this connection

—EVARTS A GRAHAM

ABOUT THE APPEARANCE OF BOOKS IN WARTIME

Recent rulings by the War Production Board have curtailed (1) the weights of certain kinds of book papers that may be manufactured and (2) the amounts of paper which book publishers may use In line with these rulings to conserve materials and man power, we are

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Slimmer books save essential materials and labor *We* are sure that readers will understand our desire to co operate as fully as possible with the objectives of the War Production Board and our Government

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GENERAL SURGERY

ANESTHESIA AND ANALGESIA

Ether—D G Revell, Jr[1] (Winnipeg) considers *ether the all-purpose anesthetic* Despite the advent of newer agents with certain advantages, ether, given by the drop method, remains the safest, most frequently used and most reliable general anesthetic agent, especially for the less experienced The intravenous route offers serious disadvantages, while the advantages of the rectal route in reality a colonic route are limited In the drop technic, cooling of the respiratory tract may be minimized by partial rebreathing and steady administration of the ether so that vaporization of large amounts does not take place at intervals The Yankauer mask is preferable to the Gwathmey for convenience, efficiency and cost Smooth administration of ether is essential for maintenance of an even plane of anesthesia To facilitate this in the semi open technic, Revell has devised a simple dripper The ether, under slight air pressure, is led from the original container to the mask through a suitable length of small caliber rubber tubing Delivery in clean easily visible drops may be regulated by a modified spigot valve so arranged as to be adjustable or shut off by merely touching it with the finger tip The dripper may be attached to the mask in any position by an expanding spring clip Its use allows a definite economy of ether frees one hand for other duties and greatly facilitates and shortens inductions

Revell has evolved an apparatus to supply almost indefinitely ether vapor of any desired concentration The principle is vaporization of liquid ether in water, in a closed container automatically kept slightly above the

(1) Canad M A J 47 235 239 September 1942

boiling point of ethyl ether The liquid ether, admitted through an enclosed visible dripper, is carried down in to the warm water by a controllable flow of air or oxygen Volatilization takes place completely and immediately in the warm water, *and the resultant vapor is led under* moderate pressure through a suitable length and caliber of rubber tubing to the patient In the most frequently used technics of undermask sufflation the vapor is re leased under a Yankauer mask closely covered with a towel Endoral, endopharyngeal or endotracheal suffla tion technics may be used or even endotracheal partial rebreathing in certain cases Temperature of the water in the vaporizer is automatically maintained within a 5 degree range just above 35 C by a thermostatically con trolled circulation of really hot water through a sub merged copper coil Besides the thorough and prompt vaporization of the ether, the resulting vapor is slightly humidified, rendering it more acceptable to the respira tory tract

The established clinical advantages provided by warmed, moist ether vapor suggest that this technic (sufflation) should be used for patients regarded as poor risks or who are to undergo protracted operation, for all infants and for every patient for whom use of endo tracheal ether by other than the closed absorption technic is contemplated

According to Harry Gold[2] (Cornell Univ), the safe ty of *use of bulk ether in anesthesia* appears to be established The danger of transfer from large to small containers by the hospital pharmacist is negligible if ordinary precautions are observed Snoke suggests that ether in 5 lb tins or 30 lb drums is practical only in institutions that have a weekly ether consumption of over 5 or 10 lb The financial saving is considerable Clarke states that "a hospital may reduce its ether for anesthesia bill by between 68 to 78 per cent a striking

(2) J A M A 120 44 45 Sept 5 1942

thought when it is realized that a million dollars' worth of ether was sold last year in small containers specially labeled for anesthesia"

Nitrous Oxide Oxygen—J Montgomerie[3] (R A M C) has devised a *modification of the field pattern Boyle apparatus* by which *carbon dioxide absorption* may be used The essential additions are a flowmeter for "basal" oxygen and a soda lime canister

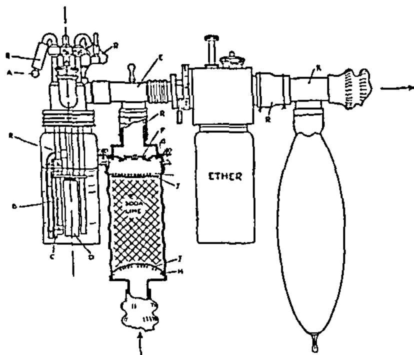


Fig 1—Front view CO_2 absorber in section *A* plug *C* scale *E* Magill's bag mount *R* rubber connections

APPARATUS—The flowmeter (Figs 1 and 3) was designed to fit inside the sight feed bottle and is of the water depression type Its design was restricted by the limited space available The oxygen cylinder is connected to the middle sight feed tube, carbon dioxide not being used Oxygen thus passes to the top of the bottle by way of the metal sleeve and tube *D* and

(3) Brit. M J 1 129 130 Jan 30 1943

boiling point of ethyl ether The liquid ether, admitted through an enclosed visible dripper, is carried down in to the warm water by a controllable flow of air or oxygen Volatilization takes place completely and immediately in the warm water and the resultant vapor is led under moderate pressure through a suitable length and caliber of rubber tubing to the patient In the most frequently used technics of undermask sufflation the vapor is re leased under a Yankauer mask closely covered with a towel Endoral, endopharyngeal or endotracheal suffla tion technics may be used or even endotracheal partial rebreathing in certain cases Temperature of the water in the vaporizer is automatically maintained within a 5 degree range just above 35 C by a thermostatically con trolled circulation of really hot water through a sub merged copper coil Besides the thorough and prompt vaporization of the ether, the resulting vapor is slightly humidified, rendering it more acceptable to the respira tory tract

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(2) J A M A 120 44 45 Sept 5 1942

used as shown in Figure 1, to prevent backflow of gases into the absorber when it is not in circuit This assembly results in some expiratory resistance due to the by pass control on the ether bottle With quiet breathing the pressure at the mask is not excessive, being between 2 and 3 mm Hg, an appreciable increase occurs with deep breathing and if the gases are bubbled through the ether

Two alternative arrangements may be used In the first, the flowmeter and ether bottle are left in their usual positions and the absorber is fitted between the ether bottle and the rebreathing bag In the second, the canister is fitted near the face-piece and to and fro absorption is used Both alternatives overcome the expiratory resistance, but ether vaporization is dependent on the small "basal" flow of gases only

Additional corrugated tube is improvised from the respirator connecting tube All rubber connections are secured by binding with wire The materials used are easily obtainable in the field and constructional work can be carried out by the nearest workshop unit It will be noted that the Boyle apparatus is not altered structurally

When this technic is used, adequate sedative pre medication is desirable A full anesthetic dose of pento thal sodium, followed by nitrous oxide oxygen anesthesia with this apparatus, has been successful When an in travenous anesthetic is not used, induction is most satisfactorily carried out by the "semiclosed" method, carbon dioxide absorption being started when surgical anesthesia is well established Owing to the diffusibility of nitrous oxide, it is seldom possible to discontinue its flow completely, and about 500 cc a minute is required for maintenance

Ethyl Chloride—S A Forman[4] describes an *instru ment for self administered ethyl chloride analgesia*, use ful in minor surgical procedures The apparatus (Fig 4) covers the nose alone, and the patient at no time feels cut off from air because the mouth is entirely free (Fig 5) No asphyxial symptoms are exhibited during ad ministration of the analgesic Before placing the in strument, it is held in the outstretched hand and its use and anticipated sensations are explained The patient is

(4) Anesth & Analg 21 318 33 Nov Dec 1942

escapes through a glass capillary *M* *T* indicates a connection to the glass depression tube *B* The scale was cut from a zinc alloy sheet and wired to the normal oxygen sight feed tube Calibration was carried out by timing the displacement of water from a large measuring bottle Preliminary experiments determined the proper size of capillary tube to obtain the desired range, 200 650 cc per minute Nitrous oxide is run in through the normal sight feed tube

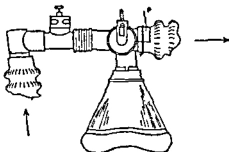


Fig 2 —Arrangement of face piece fittings *P* tin strip over slot in stopcock.

The canister was improvised from a training model service respirator container (Fig 1) The bottom (inspiratory valve end) was unsoldered and fitted as a lid by attaching lugs to receive bolts fixed to the body There are four of these, only two showing in the section A rubber washer (*G*) insures a gas tight joint A flat metal cylinder and a short length of 1 in tube soldered over the hole in the lid enables a connecting tube to be attached All the contents of the container were removed, and two of the pieces of metal gauze (*H*) with lint pads (*J*) were used to retain the soda lime, 1 lb of which can be accommodated The unfilled space of about 1 in at the upper end is important to avoid "channeling

The arrangement shown in Figure 1 works on the "circle" principle and permits vaporization of ether by the expired gases The absorber is connected to the Magill bag mount, which is fitted between the ether bottle and the flowmeter The latter is supported by an extension bracket cut from brass sheet (Fig 3, *L*) The bag is mounted on an improvised T tube (Fig 1, *K*) One way gas flow is attained by incorporating the stopcock from a nitrous oxide air apparatus, with the cap over the expiratory valve removed in the face piece fittings (Fig 2) The inspiratory valve of the respirator (*F*) is

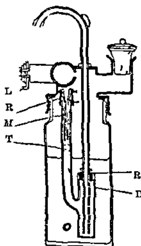


Fig 3 —Section of flowmeter

bulb quickly and vigorously, inhaling simultaneously through the nose and allowing the bulb to inflate between squeezes When he feels drowsy, he can stop squeezing the bulb and, if he wishes, he can inhale through the mouth

After the patient has manipulated the bulb several times, he can indicate by word or motion when he feels ready for the procedure Although the patient can hear the operator's voice, cooperate and even speak rationally,



Fig 5 —Instrument is held securely and comfortably in place by adjustable head straps that clip on

he will later state that "he did not mind what was done at all" He may moan, cry out or stiffen, but if asked subsequently whether it hurt badly he will insist that it did not

When the patient indicates that he is ready, it is better to wait a few seconds for the analgesia to progress through inhalation of ethyl chloride vapors from lower respiratory tract At any time during the procedure, should the patient feel or anticipate pain, he

impressed with the fact that he will not go to sleep or lose consciousness but that pain will be absent or toler able He will feel drowsy, indifferent to pain and slight ly intoxicated, with a feeling of warmth and well being and a sensation of floating through space, finger tips and

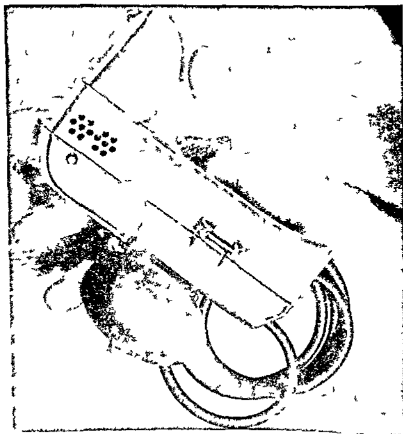


Fig 4 —Actual size of entire device Weighs approximately 1 lb

toes will tingle and numbness extend to hands, arms lips mouth and tongue

The patient is seated comfortably, with the head sup ported The instrument is then placed over his nose resting on the forehead, and securely held by adjustable straps The patient is instructed to squeeze the hand

the anesthetic is automatically stopped and the patient breathes natural air alone He cannot advance beyond analgesia through inability to squeeze the bulb when in the deeper stage of analgesia The analgesia stage lasts ½ 1½ minute, but can be extended indefinitely by the patient

In the stage of analgesia, respiration deepens but frequency does not change Eyelid reflex is present but sluggish Eyeballs are "lazy" and oscillate slowly Face may be slightly flushed

Forman has used self administered analgesia for over 3,000 cases, and the only untoward symptom has been excessive perspiration in a few perhaps due to nervous reaction Headaches and nausea occurred rarely, and vomiting never Ambulatory patients were allowed to depart unattended a few minutes after the apparatus was removed Contraindications are severe respiratory disturbances (nose colds) or any active chronic organic ailment which would contraindicate any type of anesthesia When extra time for completing a painful operation is desired and the patient can no longer manipulate the bulb, the operator squeezes the bulb a few times, thus carrying the patient into deeper analgesia or even into light anesthesia sufficient to finish the operation

Prevalence of abscesses, furuncles, paronychias, ingrowing nails and suppurating adenitis among soldiers and recruits during initial training suggests use of self administered, patient controlled ethyl chloride analgesia as an ideal way of treatment Portability is a major factor in the Army, and since the patient can administer his own analgesic fewer assistants would be necessary The potentialities of this small unit are numerous especially when nitrous oxide apparatus is not available, and the physician can carry it in his bag at all times

Vinethene —For the past two years, C E Ward[5] (Jackson, Miss) has used *vinethene in children,* chiefly

(5) Mississippi Doctor 20 304 December 194

can squeeze the bulb and inhale a few times until he is again comfortable During operation, if a painful manipulation is anticipated, the patient is told to take a few extra whiffs

The instrument is so designed that the patient at no time inhales the anesthetic alone, since plenty of air is

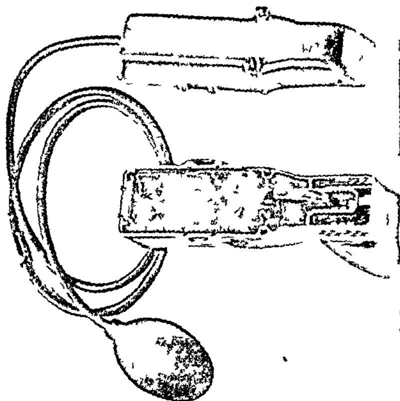


Fig 6—It takes 1 second to replace empty vial of ethyl chloride—60 cc bottle is contained with n unit The two cover knobs are loosened with a few turns and device is opened One bottle contains sufficient fluid for 40 or more administrations and is equivalent to more than a cylinder of gas

mixed with the ethyl chloride vapor Each time the patient squeezes the bulb, only a small amount of anesthetic is deposited for inhalation with air There is no danger of overdosage for when the patient ceases to squeeze the bulb or even if he maintains a constant grip

with camphor liniment and massage until such a time as there is evidence that good cutaneous circulation has been restored

During application of the spray a more intense burning and painful sensation is felt than would be felt over a normal surface area treated in the same way This sensation vanishes when the spray is stopped A mottled, reddish discoloration may remain for a time and be associated with mild itching Tenderness over the affected area may persist for some days, but as a rule pain on movement is trivial

The patient is told to carry out a full range of movement several times each day, though the part should not be subjected to excessive strain In mild cases only one application may be necessary, but in more severe ones pain returns, range of movement diminishes and a second or third application may be required. Since active movement is the basic principle of this method, immobilization by splint or strapping is definitely not to be used It is advisable to ask the patient to return on the first and third days after the initial treatment to insure that full range of movement is still present and that no untoward complication has arisen

The authors used this method in 109 cases Acute traumatic lesions of the soft tissues, when not too extensive, give the best results Within this group are placed sprains, such as those of the ankle, finger, thumb, wrist, elbow and acromioclavicular joint, and minor injuries about the knees Chronic lesions may also be improved, but the results are not so striking Late lesions of any of these conditions, tenosynovitis and pain of indefinite origin have shown remarkable improvement If there is no noticeable response, care should be taken that some other underlying condition has not been overlooked

Cyclopropane—Jack Milowsky and E A Rovenstine[6] (Bellevue Hosp) report a case of *arrhythmia during cyclopropane anesthesia* in which direct visualization of cardiac irregularities demonstrated the irritative effects of cyclopropane on rhythmicity of the heart Rate and rhythm were seen to recur when *ether* was given, demonstrating its protective action in promptly abolishing irregularities even when due to direct myocardial stimulation

(6) Anesth & Analg 21 353 356 Nov Dec 1942

for incision of abscesses and myringotomies Vinethene is conveniently carried in the bag Administration is easy and rapid Children wake almost immediately and are able to walk out of the office in a few minutes The usual precautions for protecting the eyes and skin are observed The drug is dropped from a 10 cc bottle on the open gauze mask at the rate of 60 to 80 drops per minute It can also be used in a closed gas machine An adequate amount of air is always provided Analgesia is usually obtained in 30 to 50 seconds, and myringotomy may be performed at this stage The anesthetic is stopped immediately after the operation The entire period of induction, operation and recovery takes only two or three minutes If a longer operation is performed, the patient will pass through the second stage rapidly and usually without excitement In the third stage, breathing becomes regular and quiet If intercostal activity ceases, the patient is in the fourth plane of surgical anesthesia, which should be avoided If it occurs the anesthesia can be rapidly lightened by administration of artificial respiration and oxygen Vinethene is dangerous if not carefully used in selected cases

C A McIntosh and J G Petrie[3] (M C, R C A) recommend *use of ethyl chloride spray* and active movements *in soft tissue injuries* The method is contraindicated in factures and torn ligaments or muscles of severe degree

TECHNIC —The most painful area is ascertained from the patient and sprayed with ethyl chloride till the skin is white A full range of passive movement is carried out, and the patient quickly realizes that the pain on movement is less Adjacent painful areas that originally were not recognized are sprayed in the same way until a complete range of active movement is possible without pain Too much anesthetic must not be used or frost bite may result Attention must be given to the excess ethyl chloride which may accumulate in a dependent area and produce superficial necrosis of the skin When a full range of movement is attained the area is treated

(3) Lancet 2 79 280 Sept 5 1942

lumbar puncture headache For patients with a planned, short bed stay, i e , 6 24 hours, he uses a 24 gage needle, and for routine conventional spinal anesthesia, a 21 gage needle The latter has a flexible, seamed gold shaft and nickeloid hilt Since its introduction he has not had a needle break in the body tissues during lumbar puncture For fractional or continuous spinal anesthesia he uses a *special 19 gage lumber nickeloid needle An introducer*, devised by G C Moore on the principle of a groove director, is used to guide the flexible needle through the interspinous ligament It is invaluable for facilitating accurate, speedy puncture and can be readily removed without disturbing the indwelling needle Combination of indwelling introducer and needle should be avoided

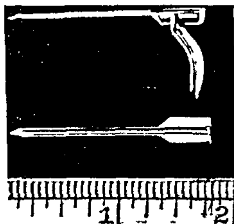


Fig 7 —Moore introducer (Hand above)

In a review of 100 private practice cases, Sidney W Ramond[1] (Chicago) shows that *spinal anesthesia with tetracaine* is highly satisfactory and is of sufficient duration for practically all procedures Adequate preoperative preparation is necessary and adds greatly to the safety and comfort of the patient In this group of patients no marked changes in blood pressure were noted and postoperative complications and morbidity were minimal Anesthesia is of two to three hours duration

Pharmacologic studies and early clinical reports on *monocaine* served to recommend its use in clinical anesthesia D L Burdick and E A Rovenstine[2] (Bellevue

(1) Illinois M J 82 141 143 August 1942
(2) Anesthesiology 3 514 521 September 1942

A study of three volunteer normal males between the ages of 25 and 32 made by E M Papper, Marvin Stern, Ernest Bueding and E A Rovenstine[7] (Bellevue Hosp) showed that *insulin shock,* occurring *during sodium pentothal and cyclopropane anesthesia,* is a real entity The most satisfactory diagnostic aid is the sudden appearance of profuse sweating followed by circulatory changes consisting of a fall in diastolic blood pressure, forceful Corrigan type pulse and tachycardia Insulin shock is easily distinguished from surgical shock in which there is a decreased pulse pressure, due largely to a fall in systolic pressure and a rapid thready pulse Diastolic pressure rises initially before the ultimate fall in "decompensated shock" If insulin shock is suspected, the logical diagnostic and therapeutic approach is intravenous injection of glucose Cyclopropane causes alterations in intermediary carbohydrate metabolism Further investigation from this standpoint is needed to evaluate its application to surgery of the diabetic

Pentothal Sodium—B H Harms[8] (Omaha) reports a *death from pentothal sodium* used *for bronchoscopy* He avers that bronchoscopies under intravenous pentothal sodium are tricky, that the point of apnea and abolition of laryngeal and bronchial cough reflexes are too close together with this drug and that presence of an expert bronchoscopist and anesthetist with plenty of cooperation between them and instantaneous oxygen under pressure are essential Colored patients are poor risks

[In our experience at the Barnes Hospital avertin by rectum is a much more satisfactory method of anesthesia for bronchoscopy Only small doses are required not enough to induce surgical anesthesia —Ed]

Spinal Anesthesia—Discussing *factors influencing success,* Leo V Hand[9] (Boston) states that the gage of the needle has a definite influence on incidence of post

(7) Anesthesiology 3 660 66 November 1942
(8) Anesth & Analg 1 357 359 Nov Dec 194
(9) J A M A 1 1 3 35 Jan 2 1943

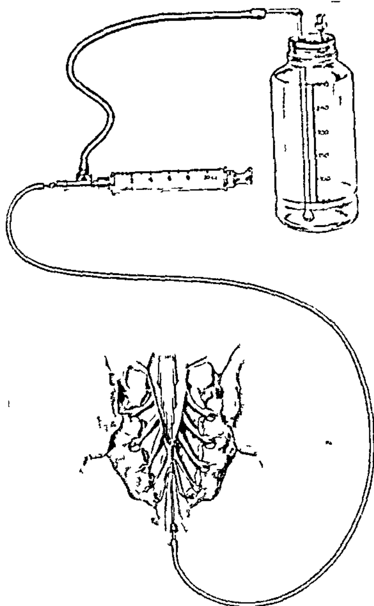


Fig 8—Assembly of needle tubing syringe and container for solution of the anesthetic agent

the beginning, cyclopropane and ether being necessary to perform the operation satisfactorily Shock while on the operating table was evident in five cases and was reported in four others after the patient's return to the ward There were four instances of postanesthetic headache Five patients died postoperatively, but in only one could the anesthetic have played any part in the death

Continuous Caudal Analgesia —James L Southworth, Waldo B Edwards and Robert A Hingson[8] (U S Pub Health Service) found this procedure valuable in plastic operations in the fields of proctology urology and gynecology, in operations below the umbilicus in the aged and debilitated in whom other forms of anesthesia are contraindicated, in thrombophlebitis and surgical and orthopedic repair of traumatism of the lower extremities and in femoral and inguinal hernioplasty It is easy to administer and to control the analgesia which can be prolonged as long as necessary, with little fear of complications

TECHNIC —A continuous caudal set is assembled (Fig 8) and a 1 5 per cent metycaine solution in physiologic saline is used The patient is placed in the prone position and the sacral hiatus is palpated With the solution a skin wheal is raised just below the hiatus A special malleable no 19 gage needle is inserted through the wheal into the caudal hiatus, piercing the sacrococcygeal ligament of Cathelin Careful aspiration is performed if cerebrospinal fluid is obtained, which may occur in anomalous low lying dural sacs, the procedure should be abandoned If blood is obtained, the needle should be withdrawn 1 2 cm and reinserted

With the palm of the left hand firmly placed on the sacrum 10 cc solution is injected When the needle lies dorsal to the sacrum an injection tumor can usually be palpated If the needle is correctly placed the patient will complain of some unusual sensation in the lower extremities such as a transient ache pain or shooting sensation in the thighs or popliteal areas After the needle is properly placed, an average of 50 cc solution is injected according to the patient's size The analgesia begins in the areas supplied by the coccygeal nerves

(8) Ann Surg 117 3 1 3?6 March 1943

Hazard of paraldehyde administration is discussed by Charles L Burstein[1] (New York Univ) Since the first report of a death attributable to this drug appeared in 1890, numerous instances of so called paraldehyde poisoning or idiosyncrasy to paraldehyde have been published He reviews a few of the reports which included autopsy findings and reports two fatal cases and results of experiments to evaluate effects of intravenous paraldehyde on cardiovascular and respiratory systems in 28 dogs, 36 cats and 24 rabbits

Paraldehyde administered intravenously is not as safe as is generally believed Autopsy findings in reported

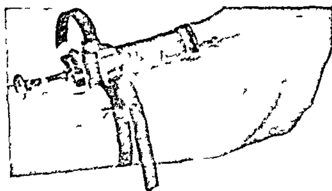


Fig 9 (Magill p 28)

clinical fatalities are similar to those reproduced in animals, namely, dilatation of right heart with pulmonary hemorrhages and edema Clinically, these fatal complications are preceded by signs of acute failure of the right heart Experimentally, rapid development of cardiac dilatation and pulmonary hemorrhages can be observed in the open chest following administration of intravenous paraldehyde

Harold R Griffith and G Enid Johnson[2] (Montreal) have administered intravenously a purified extract of *curare* (Intocostrin) to 25 patients under light *general*

(1) J A M A 121 187 190 Jan 16 1943
(2) Anesthesiology 3 418 420 July 1942

and progresses to those supplied by the hemorrhoidal, perineal, *pudendal, ilio inguinal and iliohypogastric nerves* Topographically, the analgesia usually begins about the coccyx and spreads posteriorly in a circular manner up over the sacrum and anteriorly over the perineum to the anterior abdominal wall The toes become insensitive to pain and the analgesia rises up the lower extremities In the average patient analgesia will be complete from the umbilicus down after 20 to 30 minutes

A valuable sign that the needle is properly placed and the analgesia progressing satisfactorily is flushing of toes and feet 5 15 minutes after the initial injection Cold moist feet become pink, warm and dry

Supplementary injections are given as required to maintain the desired analgesia, 20 cc every 30-40 minutes usually suffices With proper precautions, the administering syringe may be placed near the field and supplementary injections made by the surgeon or assistant When amounts larger than those recommended are used and injected with more than usual speed, analgesia can be obtained to the clavicles in many instances

Time consumed in administration and the prolonged period during which analgesia is incomplete are the most serious disadvantages 30 40 minutes is required to assemble the set, make the injection and allow the analgesia to become complete However, a *skilled anesthetist*, experienced in the method, can often have a patient ready for operation in 10 minutes

Intravenous Anesthesia—I W Magill[9] describes a useful device under the heading of *a third hand* for those who prefer the simplicity of a 10 or 20 cc syringe with the needle directly affixed It consists of a strip of brass ½ in wide bent at a right angle and perforated at each end by a rectangular hole (Fig 9) Each limb of the strip is covered by a small section of rubber tubing, the barrel of the syringe being held in the angle between them A piece of rubber from an old inner tube passes round the patient's arm and through the holes in the metal The rubber fits the holes tightly, but when traction is applied to the ends it can be drawn through and released when the desired pressure has been exerted

(9) Lancet 2 126 Aug 1 1942

first practical step in the procedure is application of a tourniquet, its material should be the most elastic rubber tubing, its width the narrowest possible (perhaps 1 25 cm) and its tightness sufficient to stop all flow of blood There is reason to believe that a human limb can survive the stoppage of blood supply as long as an animal's leg i e, 12 hours or more at ordinary temperatures The tourniquet makes possible the thorough chilling of the parts below it and prevents chilling of the remainder of the body, producing an imitation of the state of tissues preserved in an ice box though the organic connection with the body is retained Nerve impulses are abolished, protoplasm irritability and all other living activities are arrested by cold This method differs fundamentally from all previously known in producing anesthesia not only of nerves but of protoplasm Accordingly, shock is nonexistent, duration and degree of tissue trauma are immaterial and the essential factor is the state of the wound when normal temperature and blood flow are restored

The sedative action of cold controls postoperative pain to such an extent that sedatives are unnecessary or reduced to a minimum, thus avoiding harmful by effects Edema, which may be detrimental because it produces tension on sutures, because it furnishes a culture medium for bacteria and especially because it involves pressure on an already feeble capillary circulation, can be effectively checked by cold Thrombosis and embolism are avoided The exaggerated inflammatory need and the ordinary resting need of tissues for blood are reduced by cold Therefore necrosis may be prevented and sound healing obtained, if circulation is inadequate necrosis is limited and slow so that re amputations are easily performed without deaths There is thus greater freedom in selecting low levels of amputation if desired for local or systemic reasons Preservation of tissue vitality, bacteriostatic action of cold and perhaps also high oxygenation of blood and tissue fluids may explain

anesthesia In each case, temporary but complete muscular relaxation was rapidly produced with no apparent *harmful effect* *Relaxation developed* within 1 minute after injection and gradually disappeared in 10 to 15 minutes Dosage was 10 20 mg per 20 lb body weight

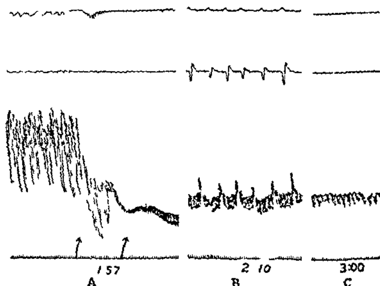


Fig 10 —Records of 10 Kg dog from above down represent thoracic respiratory movements abdominal respiratory movements arterial blood pressure and time at intervals of one second 4 5 cc paraldehyde was injected intravenously in 25 seconds Prior to injection control respiratory rate was 14 a minute and arterial blood pressure (under local anesthesia) 180/100 During injection apnea was observed while blood pressure fell to 110/40 and soon reached a level at 60/48 *B* 13 minutes after injection animal was in second plane surgical anesthesia Respiratory rate had increased to 1?0 a minute with very small excursions. Abdominal respiratory record showed definite accessory abdominal contractions every eight or nine seconds Arterial blood pressure was 80/60 *C* 0 minute later animal had regained consciousness and reacted to all forms of stimuli but respirations remained rapid (over 200 a minute) and shallow Arterial blood pressure remained at 80/60 (a fall of 5 per cent from the control reading) This animal *died* 18 hours later of acute pulmonary edema with *dilatation* of right side of heart (Burstein y 29)

Intocostrin is prepared in solution containing 20 mg active curare substance per cc so that an average adult dose is 4 5 cc

Refrigeration Anesthesia for Limb Operations — Frederick M *Allen*[4] (*New York City*) states that the

(4) Anesthesiology 4 12 16 January 194

many instances *refrigeration* used as a method of anesthesia will be synonymous with method of treatment For instance, in war surgery the procedure could be used either with or without a tourniquet for treatment of compound fractures, gunshot wounds crushing injuries and severe infections, especially with the gas bacillus as anesthesia in alleviation of pain or for contemplated surgery *and also to inhibit shock and minimize* infection If used under war conditions, men with limb wounds could be transported without hemorrhage, pain or shock and without advance of infection or tissue devitalization and anesthesia would already be induced for operation A 200 lb apparatus can be operated by the motor of a truck or ambulance and can refrigerate four to six limbs simultaneously Refrigeration is usually available on naval vessels

Refrigeration may also be used to prevent peritoneal adhesions in limited locations and offers remarkable opportunities for drainage and irrigation The refrigeration method with some modifications could occasionally prove useful with snake bites of the limbs With prompt cooling of the limbs the time limit for embolectomy could be lengthened beyond four hours Anesthetists are likewise concerned with use of intravenous fluids, and studies show that one should have no fear in injecting cool solutions intravenously Refrigeration anesthesia should probably be tried for patients inoperable by any other method

Accidents and Complications—Bronson S Ray and Victor F Marshall[1] (New York City) made an analysis of 12 cases of *convulsions occurring during general anesthesia* The incidence is about 1 6 000 The mortality rate is 25 per cent, too high to be the result of convulsions alone The term "ether convulsions" is misleading since convulsions may occur during other types of general anesthesia Most alleged causes of the convulsions are not of a nature to be alone or directly responsible,

(1) Ann Surg 118 130 148 July 1943

the noticeably high resistance to infection in these cases

Closure using silk without drainage is the ordinary rule, but anything from small drains to a wide open wound may be adopted, according to the degree of infection Unfavorable tissue reaction to drains is prevented by cold The character of the discharge, also, is noteworthy Even if it is dark, thick or putrid at the outset, it soon changes to a profuse, thin, serous liquid, colored bright pink with hemoglobin Cold prevents sealing of wound edges *and pocketing of exudate* Closely apposed flaps thus may remain ununited and irrigated from within as long as chilling is continued Whenever it is desired to stop the drainage, elevation of temperature results in rapid agglutination of the wound margins

Healing is delayed by cold Accordingly, duration of refrigeration should be the shortest compatible with safety With two or three days of postoperative chilling, skin sutures are best not removed until about the twelfth day The typical result with refrigeration is a slow but perfect primary union

Allen recently tried to extend the method by using an abdominal tourniquet and refrigeration of the entire part of the body below it This plan is still in the experimental stage and is designed only as an attempt to save life in cases of wounds of the limbs and lower trunk of such severity that they are hopeless under existing methods

[Allen s ideas are very interesting and deserve serious *considera*tion There is need however of much more careful experimental work before many of them can be accepted For instance the work of Brooks and Duncan (1942 YEAR BOOK OF SURGERY, p 130) casts serious doubt on the wisdom of inhibiting an inflammatory reaction by the application of cold Such an inflammatory reaction is a natural response *The fact that anesthesia will be induced* by cooling the tissues has of course been known for a long time It has been demonstrated by the long established custom of using freezing sprays (ethyl chloride etc) to induce local anesthesia —Ed]

According to Nevin H Rupp[5] (Reading, Pa) in

(5) Anesth & Analg 22 46 51 Jan Feb 1943

Improvement in respiration with these procedures is accentuated by atropine and provides additional evidence to justify the preoperative use of this drug, if not actually to extend its use

[Atropine will often make the bronchial secretions so thick and viscid that it is difficult for the patient to cough them up This property of the drug doubtless leads to the production of atelectasis in some cases.—Ed]

Because of the increased need for morphine in time of war and the present threat to the opium supply, Robert C Batterman and C K Himmelsbach[3] (New York Univ) call attention to *demerol, a new synthetic analgesic* which possesses three main actions analgesia, spasmolysis and sedation

With the exception of the production of cough and diarrhea, demerol is a satisfactory therapeutic substitute for morphine It appears to possess the following clinical advantages over morphine (1) Its spasmolytic action makes it ideal for the relief of conditions due to smooth muscle spasm, in which morphine is pharmacologically contraindicated (2) Its rapid dissipation tends to offset undesirable cumulative effects such as respiratory depression and urinary retention (3) Prolonged use of demerol may lead to habituation, but it appears to possess a lesser liability than morphine for development of physical dependence

To avoid the dangers of habituation, physical dependence and undue cerebral irritability amounts greater than 150 mg every three hours should not be given If this amount will not meet the clinical need, increasing the dose and shortening the interval may not have any additional therapeutic value and is apt to result in serious consequences

Walter G Haynes and Frederick A Smith[4] (Lovell Gen'l Hosp) report a case of *cervical arachnoiditis* four days after an operation on the leg for which a pontocaine glucose *spinal anesthesia* had been given Pain,

(3) J A M A 122 22 26 May 22 1943
(4) Anesthesiology 3 444 447 July 1942

but most of them bear some relationship to the delivery transportation and utilization of oxygen for tissue respiration, thus suggesting anoxia as the chief factor in precipitating convulsions Since the cells of the brain are more sensitive to anoxia, convulsions often appear before other signs, but when convulsions do appear an advanced state of anoxia may already exist

The incidence of convulsions during anesthesia may be lowered by attention to the preparation of the patient for operation, to the proper administration of the anesthetic and to the contributing effects of the operation itself When convulsions occur, all measures should be directed toward correction of the causative factors and alleviation of the state of anoxia Some form of barbiturate should be given intravenously to control the convulsions

In their experiments on dogs, L Corsan Reid and Donald E Brace[2] (New York Med College) found that placing the muscles of the neck, tongue mouth, pharynx, trachea and esophagus on the stretch gives rise to *reflexes which stimulate respiration* and heart rate The accumulation of metabolic products in muscle stimulates local nerve endings which set up reflexes that stimulate respiration and circulation These reflexes are potentiated by atropine and those from the trachea and esophagus by the topical application of butyn They are decreased by physostigmine The effects from stretching of tracheal muscles probably and from esophageal muscles certainly, persist after bilateral vagal section

These procedures, or suitable modifications, should facilitate resuscitation under any condition in which the respiratory center is depressed The benefit from use of intratracheal tubes, pharyngeal airways, extension of the head and pulling forward of the tongue so frequently used in clinical anesthesia depends in part at least on the initiation of a reflex stimulus to respiration

(2) Anesthesiology 4 345 360 July 1943

the so-called "premetastatic" phase of malignancy Burning, urgency, tenesmus and other pains were not relieved

At time of injection, severe pain is experienced in the periphery supplied by the area bathed with the solution This can be eliminated by preceding the injection with 50 mg procaine hydrochloride, which produces mild spinal anesthesia

Many patients developed nausea and vomiting following injection Temporary motor effects were observed in several patients Two had temporary urinary incontinence lasting 24 and 48 hours, respectively, one had temporary bowel and bladder effect Blood pressure readings were unaffected but a few patients showed slight temporary rise

The solution should be well diluted with spinal fluid while being injected Since optimal results develop from a concentration of 5 10 mg per cc, introduction of a solution of this strength is unpractical because it is immediately diluted Therefore it is necessary to use a more concentrated solution, 50 70 mg per cc and dilute it carefully and slowly with spinal fluid Undue reactions appear to be due to insufficient dilution of the ammonium salts

In nearly all instances in the group of failures pain was not associated with tenderness of the sensory segments However, in the patients who developed metastases with root pain and tenderness, many excellent results were obtained This observation has been further confirmed in patients with pain of known sympathetic origin i e coronary disease and vascular occlusion of the extremities

Permonid compound is recommended by Giulia Drack[6] (Winterthur) to combat pain of accidents operations and colics Permonid is dihydrodesoxymorphine hydrobromide which has an analgesic action 5 10 times

(6) Schweiz med Wchnschr 900 903 Aug 15 1942

anesthesia, muscle weakness and atrophy were present in varying degrees in both shoulders, arms and hands Cervical laminectomy two months later revealed the pathologic process and restored to a large extent the functions of the involved structures

The *Cumulative Index* from 1925 to 1940 shows no *reference to cervical arachnoiditis following spinal an* esthesia The authors are unable to prove whether or not spinal anesthesia was concerned with development of cervical arachnoiditis in this case, however, as this particular sequence of events did occur, they report it for the sake of record

William Bates and Bernard D Judovich[5] (Philadelphia) treat *intractable pain* with intraspinal injections of ammonium sulfate Optimal dosage appears to be 200 400 mg in 5 cc distilled water, 5 cc spinal fluid is withdrawn and the solution injected in one minute It is necessary first to determine which spinal segments are involved This is done by interpretation of distribution of pain Injection should be at the level of the spinal cord segment and not at points of emergence of the roots from the spine

Since the solution is heavier than spinal fluid, injection is made with the painful side turned down If pain is bilateral, the patient is placed flat on his back Pain due to the injection usually lasts only several minutes, but may persist for two hours With pain in the lower half of the body i e from midthorax to lower extremities head and shoulders should be kept slightly elevated This is done not to prevent the solution from ascending to a high level but to keep it where it will contact the area desired Position should be maintained for half an hour following injection The solution causes no ill effect when injected at a high level and the patient is placed *in the Trendelenburg position* Intraspinal ammonium sulfate did not yield satisfactory results in

(5) Anesthesiology 3 663 672 November 1942

travenous injection and within four to five minutes after intramuscular injection, has a moderate but persistent action and does not increase the pulse rate or cardiac output even when the dose is repeated

Candidates for spinal anesthesia are tested with veritol several days before operation Systolic and diastolic pressures and the pulse rate are taken and an ampule of veritol is injected intramuscularly The result is positive if after three minutes the arterial pressure is increased while the pulse is practically unchanged, it is negative if the arterial pressure remains unchanged while the pulse rate is decidedly increased The positive result indicates good vasomotor reaction and promises a favorable response to cardiovascular tonics in case of shock The negative result suggests the necessity of digitalization for several days, after which the patient sometimes shows a positive response to the test

The authors used the test in 50 patients 4 gave a negative result, 2 of whom became positive after digitalization, the other 2 were operated on regardless and both died from collapse, 1 during and the other a few hours after operation

Veritol sulfate was used as the sole hypertensive drug in a number of cases to avoid hypotension or to regain normal values when hypotension occurred The patients were given an injection of morphine, 0 01 Gm, 1 hour before operation and an intramuscular injection of veritol 15 minutes before spinal anesthesia with percaine In only one case was it necessary to use an additional intravenous injection of veritol Most operations were performed for grave processes in subjects between 50 and 75 years of age Veritol is also an excellent antishock agent in traumatisms burns and the immediate postoperative period, it may be given mixed with blood, plasma and serum transfusions or associated with circulatory analeptics having a central action Compared with adrenalin, veritol has the advantage of slower, more moderate and more persistent action and of the possi

stronger than that of morphine, causes less vomiting and involvement of musculature of the bladder and intestine and has less narcotic side effects However, it has a decided action on the respiratory center As this substance seemed particularly appropriate to serve as base for combination with scopolamine and ephedrine permonid compound was tried experimentally in a 1 cc ampule containing 0 002 Gm permonid, 0 0005 Gm scopolamine hydrobromide and 0 025 Gm l ephedrine hydrochloride

Relief from pain due to accidents is sudden after intravenous injection of 1 cc, lasts four to six hours and allows thorough examination of the patient It was used mostly subcutaneously but also intravenously and intramuscularly, in preparation for anesthesia and operation and during operation in 409 cases Postoperative pain was greatly delayed in most cases (4 10 hours) and did not appear in 6 per cent It had favorable effect on ether anesthesia practically abolishing the stage of excitement and postanesthetic vomiting, it deepened nitrous oxide narcosis, but caused cyanosis and tachycardia lasting 10 15 minutes in lumbar anesthesia Dose was usually 1 cc, but varied from 0 5 to 2 cc Severe colic, particularly from stone in gallbladder or urinary passages, responds to permonid compound better than to morphine or pantopon pain stops suddenly and relief lasts five to six hours In a case of tetanus, control was maintained for 12 days, six ampules in 24 hours were well tolerated

Hector A Venturino and Jorge L Viaggio[7] (Buenos Aires) studied the effect of *veritol in spinal anesthesia* This substance is used in the form of sulfate by mouth (3 per cent solution) and by injection (1 cc ampules containing 0 02 Gm) It stimulates the peripheral circulation, especially when the return flow to the heart is impeded, takes effect within a few seconds after in

(7) Semana méd 49 568 572 Sept. 3 194?

solution of 1 1 000 and therefore does not cause the pain produced by an agent that is dissolved in alcohol Proflavine however is probably too strongly acid to apply directly to wounds in a powder form Much work is constantly being done in the development of new acridine compounds especially by Albert of Sydney Australia —Ed]

Local effect of sulfanilamide sulfathiazole and sulfadiazine on hemolytic Staphylococcus aureus infections of the pleural cavity and peritoneum was studied in dogs by Rollin A Daniel Jr F T Billings and Richard R Crutcher[5] (Vanderbilt Univ) There is little gross local evidence of reaction to sulfanilamide or sulfathiazole used in the pleural cavity following pneumonectomy Sulfadiazine produces a more marked inflammatory reaction than do the other drugs Sulfathiazole used locally is more effective in preventing hemolytic staphylococcus empyema following pneumonectomy than is either sulfanilamide or sulfadiazine Local use of sulfanilamide is least effective in prevention of this infection Absorption of sulfanilamide from the contaminated pleural cavity is slightly more rapid than that of sulfathiazole Absorption of sulfadiazine occurs much more slowly than of either of the other drugs A greater incidence of wound disruption in animals in which sulfathiazole was used suggests that this drug may have interfered with the healing

The three drugs may produce adhesions in the peritoneal cavity under certain conditions These adhesions may persist for long periods Masses of the drugs are apt to become walled off as a foreign body and be absorbed slowly The finely powdered drug should be distributed evenly about the available surface of peritoneum to avoid formation of lumps by introducing the drug in a suspension of sterile water or saline Sulfadiazine produces much greater local reaction than sulfanilamide or sulfathiazole Absorption of sulfadiazine from the peritoneal cavity occurs more slowly than that of sulfanilamide or sulfathiazole

(5) Ann Surg 117 670 685 May 1943

bility of oral administration, compared with ephedrine, it does not reduce cardiac activity even when its dose is repeated

ASEPSIS AND ANTISEPSIS

Present status of aminoacridine compounds (flavines) as surface antiseptics is discussed by C H Browning[4] Flavines were introduced because they combined outstanding antiseptic properties with relatively low toxicity, as demonstrated by simple methods in vivo and in vitro Later tests in vitro yielded discordant results which throw doubt on their value as a practical means of selecting drugs for such purposes

Proflavine is the precursor of acriflavine and thus cheaper also while equally antiseptic it is the less toxic generally, and especially causes little harm to brain tissue Recently introduced members of the series may prove even more suitable for therapy Under experimental conditions, the flavines applied to the tissues at the site of inoculation are highly effective in preventing development of infection with various organisms including streptococci and certain gas gangrene anaerobes There is also good clinical evidence that they can control established suppuration in wounds This may occur where sulfonamides have failed

Retardation of granulation and healing tends to follow continued use of the flavines so that it may be advantageous to resort to other treatment later But the point of practical importance is the capacity of the flavines to prevent or control infection This so called "pickling' or 'cold storage' effect has allowed wounded men to be transported without redressing with the fair likelihood that their wounds would remain in statu quo as regards infection

[A flavine such as proflavine sulfate or hydrochloride is a rather satisfactory antiseptic for home use It can be used in an aqueous

(4) Brit M J 1 341 343 Mar 20 1943

tried Sutures are removed about the tenth day and, while passive movements are continued, there is a daily gradual increase in the range of active movements In three weeks, apart from tenderness of the stump, the hand is useful Splints in finger amputations are undesirable What is said about digits applies equally to the larger joints The surgeon has a definite responsibility in stimulating confidence and teaching the patient to use his appliance

Walking should be carried out according to the following program (1) The walking stick should be held in the hand on the sound side, otherwise the patient will not bear weight on the artificial limb and will never learn to walk properly (2) The first attempt to walk is made by advancing the normal limb a short step forward, then dragging the artificial limb up and forward The patient feels insecure, and he must be taught as soon as possible to take long steps (3) Next he must be taught to advance the artificial limb and bring the sound one beyond it This makes the beginning of a normal gait

Walking upstairs, the patient should always step first on the sound limb The patient learns to turn first by short paces, then more quickly by ordinary paces Simple dressing lessons, walking on rough ground, are additional exercises as the patient progresses

It is a question whether an artificial limb should be furnished the elderly person with marked arteriosclerosis, one whose heart shows limited compensation or the obese, awkward patient In such persons attempts to use the part effectively may result in shortening life

MacDonald draws attention to so called refrigeration treatment of cases of exposure of the feet principally among seamen Summary of results in 188 cases shows that there is uniformly early relief of pain the limbs tend to regain vitality and gangrene is averted Toxic absorption is definitely lessened, and there have been no ill effects These results are gratifying, but it is early

Robert Williams, Barbara Clayton Cooper, J McK Duncan and Ellen M Miles[6] report their *observations on the surgical use of CTAB* (cetavlon or cetyl trimethyl ammonium bromide) One per cent CTAB is an excellent agent for cleansing surfaces of organic matter and has considerable antiseptic powers on already clean surfaces It is an effective disinfectant against pyogenic cocci and the gas gangrene organisms, but variable in its action on coliform bacteria It is recommended for the cleaning and sterilization of utensils and instruments and for cleaning of wounds and the skin surrounding them

It is also highly effective for removing dirt and bacteria from the hands of the surgeon and nurse and far more efficient than scrubbing with soap and water In this respect it appears to be an admirable substance to apply to the hands of surgeons and nurses in gloveless surgery There are, however certain drawbacks notably skin reactions in a small percentage of sensitive persons, whose importance can be best determined by extensive trial in surgical practice The chemically related detergent, cetyl pyridinium bromide is less likely to induce highly sensitive reactions

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OPERATIVE TECHNIC

Amputations—H K MacDonald[7] (Halifax) considers *after treatment* In absence of sepsis too frequent dressings are to be avoided Dressings should be changed 48 hours after amputation of digits, *in addition*, stumps are passively moved through the full range of each joint Passive movements are carried out daily and after the first week gentle active flexion may be

(6) Lancet 1 522 525 Apr 24, 1943
(7) Canad M A J 47 229 233 September 1942

the femur After amputations which leave about 4 in of femur, a special prosthesis is designed because this stump cannot be accommodated in the ordinary type socket and there is no stump control This stump is flexed to 90 degrees from normal and a socket fitted halfway around the pelvis It is desirable to leave a part of the head of the femur for comfort

Below Knee Amputations Weight bearing by the head of the tibia, with a leather corset fitted round the thigh for some support, may cause severe bursitis A longer corset takes the full weight on the ischial tuberosity Calf muscles should be cut away to produce a conical stump with ends just above the resultant scar A soft flabby stump is more uncomfortable and more difficult to fit than a thinly covered one Stump length is measured from the inner articular surface of the tibial head to the amputated end of the tibia and all that is required is 5 5½ in The fibula must be at least ½ in shorter than the tibia The sharp front edge of the tibia stump should be beveled The scar should be about 1 in from the end of the stump on the posterior surface, formed by a large anterior flap with no superfluous tissue The surgeon should treat the nerve with extreme care

Stump Treatment This should begin from the day of operation The stump does not require a pillow but should lie extended in below knee amputation a back splint is often necessary to prevent flexion of the knee joint After stitches are taken out active exercises should be started while the stump is still bandaged Movements of the joint must be encouraged to tone up muscles and assist in tissue reduction in the stump Massage is inadvisable In general pylons are not necessary The modern method is to bandage the stump with crepe bandages from the time the stitches are taken out An above knee stump requires only three weeks' bandaging to make it fit for measuring for prosthesis thus actual limb fitting can take place in less

to estimate the comparative advantages of refrigeration

A W J Craft[7] (Roehampton) discusses *surgical amputations and fitting of artificial limbs* Records com piled by the Ministry of Pensions in 25 years show that periodic examinations of amputated stumps are desir able Only certain lengths and types of stumps render further surgery unnecessary

Above Knee Amputations When walking, weight is borne by the foot and when sitting, by the ischial tuber osity If the lower limb is amputated at any level, weight should therefore be supported by this tuberosity The stump should fit into the socket of the prosthesis which is carefully shaped so that the ischial tuberosity rests on the inner edge the patient thus sitting in the socket On walking he naturally lifts the stump a trifle out of the socket producing a slight "piston" action which is not detrimental to the stump except when the scar is terminal and adherent to the amputated end of the femur There should be no scar tissue near the tuber osity head of the great trochanter or upper part of the thigh if this can be avoided

Muscles of the thigh are used to control the prosthe sis The ideal stump length is 10 12 in from tip of the great trochanter to amputated end of the femur The larger anterior flap method insures a transverse pos terior scar about 1½ in from the end of the stump If complete hemostasis is obtained no drain is required and wound will heal quickly Flaps need contain only enough tissue to maintain their own nourishment, any superfluous tissue may cause discomfort in wearing the prosthesis The sciatic nerve should never be crushed ligated or stretched it should be dissected out and sev ered a little shorter than the muscles

Short Above Knee Stumps Chief consideration is to preserve as much of the adductor musculature as pos sible and to avoid complete disarticulation of head of

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(7) Brit M J 2 389 39 Oct 3 1942

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than eight weeks from day of amputation The band ages, 6 in wide, must be wound tightly and evenly to obtain firm application to the stump For a below knee stump the 4 in crepe bandage is used

Arm Amputations The ideal length of an upper arm stump is 8 9 in from tip of the acromion process If the stump must be shorter, at least ½ in of the humerus should be left below the axillary fold to allow good control over the artificial arm If a smaller length must be left, endeavor should be made to leave some part of the head of the humerus A terminal scar from equal anterior and posterior flaps is ideal, again with little tis sue in the flaps and a conical stump Adhesions of mus culature to end of humerus must be avoided Length of the lower arm stump from tip of the olecranon to am putated end of the ulna should be about 7 in with the elbow flexed The radius should be at least ½ in shorter than the ulna An artificial arm can be used if at least 3½ in is left, but in such a case more muscle tissue must be trimmed away and a real bony stump left The stump requires bandaging with 3 in crepe bandage and exer cising to encourage joint mobility The artificial arm should be fitted as soon as possible

Children should not be fitted with nonarticulated peg legs Whether for arm or leg a prosthesis should be fitted at an early age

Gangrene in old people with diabetes or arterio sclerosis frequently calls for *amputation through the thigh* To avoid dangers caused by surgical disturbance of blood supply, K Scheele[8] advises the *fish mouth in cision* By imitating the through and through stab inci sion, he obtains anterior and posterior skin muscle flaps in which the skin remains connected with the subcuta neous tissues

TECHNIC —The surgeon grips and elevates quadriceps with left hand and introduces a long pointed amputation knife

(8) Zentralbl f Chir 69 11 1 Jan 194?

toward the femur, making contact with its upper surface, he slides the knife over the bone and pushes it through to the other side With long sweeping cuts passing obliquely forward and distally, the muscles are divided until the level of the distal edge of the proposed skin flap is reached Here the knife is turned until its cutting edge points forward and the skin is divided vertically The posterior flap is formed in the same manner A circular cut through muscle tissue at the level where the flaps meet frees the bone for division A drain is inserted into the angle where the flaps meet and muscle and skin are closed with interrupted sutures The stump obtained by this procedure is well covered with muscle without bulging and skin and bone are well separated by interposed tissue The scar passes in a curve over the lower surface of the stump and is not exposed to pressure in the prosthesis The procedure is easier and quicker than a racquet incision, and avoids risk of necrosis of the flaps

His experience with 900 cases (see Table) leads D J Leithauser[7] (Detroit) to recommend *confinement to bed for only 24 hours after operation*, as there are several important postoperative reflexes originating from wounds and traumatized areas which initiate pathologic changes leading to complications The effect of the reflex to the diaphragm can be measured and expressed in the percentage of reduction of vital capacity In some instances the reduction is over 60 per cent on the first postoperative day, and 7 to 14 days is usually required for vital capacity to return to normal Pulmonary complications increase in direct proportion to the reduction in vital capacity Fifty per cent of pulmonary complications are established in 24 hours and 90 per cent appear by the fourth day

In pulmonary complications coughing in the standing position if instituted during the first 24 hours (when the vital capacity is at its lowest level) will invariably promptly expel the mucus and cause disappearance of the rales Repetition of the exercises as occasion demands will maintain clear lung fields

Coughing in the standing position is particularly

(7) Arch Surg 47 203 215 August 1943

effective, since the downward pull of the abdominal contents lowers the diaphragm, permitting air to enter the collapsed tubules beyond the mucous plugs The lowering of the diaphragm appears to be the explanation why the vital capacity returns to normal so rapidly (in two to seven days) when early rising is instituted

Average Number of Days of Confinement to Bed and to Hospital After Operation in 900 Cases

Classification of Operations	Total Cases	Days in Bed	Days in Hospital
Appendectomy			
Chronic appendicitis	147	14	25
Acute appendicitis	487	12	23
Ruptured appendix	10	10	94
Celiotomy (exploratory)	7*	10	99
Cholecystectomy	43	1.3	78
Cholecystotomy	3	17	247
Choledochostomy	4*	10	68
Duodenal diverticulum removal of	1	10	70
Gastrectomy recoveries	3	13	107
Gastrectomy deaths	2	10	250
Gastro enterostomy	3	1.3	87
Herniorrhaphy inguinal indirect (5 bilateral)	41	11	68
Herniorrhaphy inguinal direct (1 bilateral)	10	12	70
Herniorrhaphy femoral (1 bilateral)	3	10	137
Herniorrhaphy incisional	5	10	72
Herniorrhaphy umbilical	4	10	45
Intestinal adhesions separation of	3	10	77
Intestinal resection (obstruction)	1	10	170
Marsupialization of pancreatic cyst	1	50	500
Mastectomy (radical 5 simple 2)	7	10	53
Pelvic operations (hysterectomy salpingectomy oophorectomy etc)	49	14	74
Pelvic operations tubal pregnancy	5	10	52
Pelvic operations with perineal operation	4	10	100
Perforated duodenal ulcer	1	10	90
Perineal operations (interposition colporrhaphy etc)	10	10	84
Prostatectomy	1	20	180
Rectal operations	15	10	39
Renal operations (nephrectomy lithotomy etc)	7	14	106
Splenectomy	2	20	85
Operations on the colon (cancer)	6	10	130
Thyroidectomy	15	18	56
Total	900	13	40

* One death.

The curve of postoperative vital capacity is also an index of the stage of convalescence Recovery after an abdominal operation improves with the improvement of this curve This is graphically demonstrated by comparable vital capacity curves and case reports These comparisons emphasize the importance of instituting early rising at the low level of the vital capacity within the first 24 hour period Recent observations show the most effective time to be immediately after recovery from the anesthetic

The effect of early rising on other reflex changes, such as inhibition of the vital organs and reflex vascular changes that lead to thrombosis is emphasized

Dehiscence, incisional hernias and recurrences following inguinal herniorrhaphies were not more frequent after early rising There was no instance of eventration in the 900 cases The tensile strength of sutures is greater during the early postoperative period and healing is promoted through ambulatory activity, as Kimbarovskiy and others have demonstrated Thus the incision of the patient who rises early should stand the strain more readily than that of the patient who rises at some later date So far as dehiscence and eventration are concerned, the most dangerous time to get up is between the fifth and the tenth day the lag period in healing which is not present when early rising is used

Limiting confinement to bed to 24 hours relieves postoperative distress and rapidly restores the patient to health and to ability to work This should be of tremendous value during the present emergency, especially to the armed forces for whom rapid recovery and mobility are so essential

This practice can be applied to all surgical procedures mentioned in this article in practically all instances provided the type of incision is well chosen and the wound is properly closed with well selected suture material

The chief obstacle to early rising is fear and respect

for tradition on the part of surgeon and patient Pain and discomfort are insignificant Even the neurotic or fearful patient, who thinks he is too sick to move, is enthusiastic about early rising once it is established A common explanation for the presence of complications is, "He got up too soon", but in reality he got up too late

[The idea of having patients get up soon after operation and of discharging them as soon as possible from the hospital is an old one which is revived from time to time For some reason however the idea seems not to stick hence the frequent revivals Could not the reason be that the plan does not work satisfactorily? After all John Hilton expressed a rather good idea when he emphasized the importance of the role of rest in the treatment of inflammation —Ed]

Present Status of Cooling Limbs in Preparation for Surgical Procedures —Robert T McElvenny[9] (Northwestern Univ) states that patients undergoing amputation by this method have no pain and do not need an anesthetic, the operation is practically bloodless shock is greatly diminished the mortality rate is far lower and the results are as satisfactory as by any other method In addition the time a tourniquet can be left on a limb without disastrous results is greatly prolonged

McElvenny cites two cases in which gangrene was arrested, the foul odor eliminated and amputation performed three and five days, respectively after beginning of the icing The question of how long normal skin can stand the application of ice without showing disintegration has been an interesting speculation Therefore, he mentions the case of a man, 70 with gangrene of the right foot and ankle whose limb was encased in shaved ice to above the middle of the calf for 28 days without damage to the normal skin enclosed in the ice A mid thigh amputation was then done and recovery was uneventful No tourniquet was applied at any time in this case except at amputation Thus, cooling alone can, by lowering the metabolism of a part, prevent the absorption of toxin and the advance of bacterial infection and can relieve pain

(9) Am J Surg 58 110 11 October 1942

To avoid unsightly scars and suture marks, R von Fellenberg[1] (Bern) recommends making the incision in direction of skin tension and using the *intracutaneous suture* method even in long transverse incisions of large laparotomies which may reach 15 cm and more He uses a fine needle with no 1 catgut and removes the suture on the third day Those who fear that the edges of the wound will not hold together after so short a time can apply a strip of adhesive plaster over the wound, leaving the ends of the suture uncovered at first and complet ing application of the strip after removal of the suture During his long practice he has never encountered this accident

[Surgeons should always strive for the best possible cosmetic results Too often they fail to consider the psychologic effect on the patient of a bad scar even if it is concealed beneath the clothing —Ed.]

Instruments and Appliances — Henry I Goodman[2] (New York Polyclinic Hosp) describes a *new surgical sutur ing instrument with a continuously threaded needle* It is made of stainless steel with a dura lumin handle finished in black, unaffected by sterilization

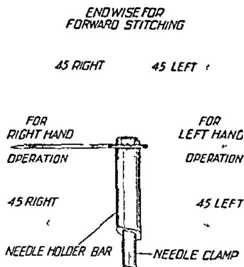


Fig 11 —Different settings of the needles

INSTRUMENT —There are three component parts a needle clamping control nut at the base of the handle a spool holder, easily controlled by thumb pressure and a special needle clamp at the end of the instrument (Fig 12) Needles are interchangeable and can be set at several different

(1) Schweiz med Wchnschr 72 795 July 18 1942
(2) J A M A 120 281 283 Sept 26 1942

angles (Fig 11) A needle, when it is once inserted, remains fixed throughout the entire suturing procedure

The handle is hexagonally grooved and has within it a tension spring which allows adjustment of the needle to a new

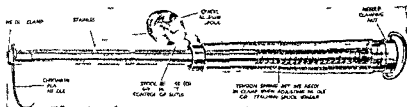


Fig 12 —Section of instrument

Fig 13 —Technic for interrupted sutures.

position without possibility of its falling out The fenestrated spool fits into a holder so as to reduce contamination to a minimum Owing to a simple self locking device, the suturing material on the spool cannot unravel and the amount that can

be withdrawn is controlled by slight thumb pressure on the control knob The spool has a capacity of about 53 ft of C silk Catgut, nylon, cotton and alloy steel wire may be used *instead of silk The entire instrument with loaded spool may* be sterilized by boiling, or autoclaving

The spools are easily wound The spool winder is first attached to the handle of the instrument beneath the loosened clamping nut The suture material is passed through a tension spring arrangement then inserted into the spool through one

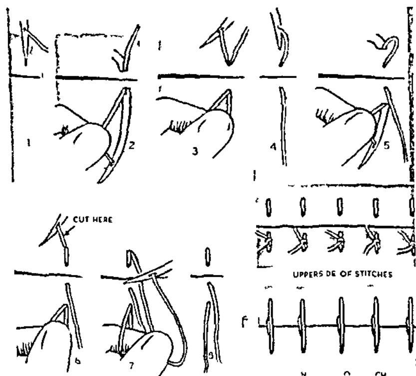


Fig 14 —Technic for interrupted sutures

of the side openings With this tension control, the spool can be uniformly wound with suture material by twirling the spool holder

The needles for this instrument are of various sizes and shapes Some of the larger needles have a finely ground lance edge on one side By the particular design of these needles and position of the lance edge, penetration through firmer tissues is easy Of equal importance is use of the lance edge in cutting the suture after the knot has been tied, thus greatly facili

tating suturing Catgut and fine wire may not be cut Each needle, regardless of how fine, has two eyes through which the suture material is threaded, preventing unthreading of the needle The suture material always rests in a groove on the under surface of the needle to reduce trauma All needles are made of finely tempered steel and are chromium plated

With this instrument, a variety of stitches becomes possible, some entirely new in surgical technic A few of these new sutures and the technic of making them are illustrated (Figs 13 and 14) By cutting away the first and last knot of certain continuous sutures, the entire suture may be removed in a single strand This instrument simplifies and improves suturing technic and may be used equally for superficial and deep suturing Clamping and unclamping during suturing are eliminated The needle may be quickly set at eight different angles Rethreading is eliminated The large capacity of the spool saves rethreading during operation The amount of suture material is easily controlled by thumb pressure on the spool release

William A Hudson[3] (Detroit) describes an *instrument for severing staples and similar objects in the air and food passages* It consists of a tubular shaft in the wall of which are two small canals which run the full



Fig 15 —Instrument for severing staples and similar objects.

(3) Ann. Otol. Rhin & Laryng 51 1076 December 194?

length of the shaft Through these small canals are threaded the two ends of a looped wire, the loop falling directly over and bent at right angles to the distal end of the main canal The proximal ends of the wire are attached to the two jaws of a handle Through the main canal is inserted a drill, which can be run by hand power or by an electric motor The object is caught between the loop and the end of the shaft and is held in place by the loop, while the drill severs the object A set screw on the drill shaft prevents the drill from passing beyond the object into the adjacent soft tissues

D Lang Stevenson[4] found small *clamp for abdominal surgery* of considerable value The clamp (Fig 16) is 8

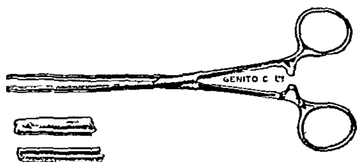


Fig 16

in long with a blade length of 3¼ in The closed blades on the flat taper from ¼ to ⅛ in at the tips, while on the opposite aspect they have a uniform width of about ⅛ in The clamp combines to an unusual degree the advantages of lightness, slenderness and strength Intestine is held securely in the bite of the narrow blades by means of a single deep longitudinal groove in one of them and a corresponding ridge on the other In these respects this clamp excels any other designed for the same purpose With the extreme cut edge of stomach or intestine in the control of the clamp, a clean and bloodless closure or anastomosis is greatly facilitated This instrument has proved its usefulness in simplifying and

(4) Brit M J 1 13 Jan ? 1943

perfecting technical procedures for closure of the duodenal stump in gastrectomy, aseptic anastomosis after resection of bowel and closure of colostomies or intestinal fistulas

Arthur H Parcher[5] (Ellsworth) describes a *board splint* modified to permit its application in various posi

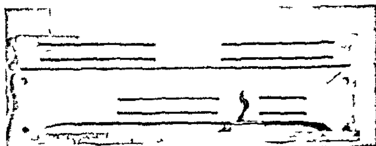


Fig 17 —Top section C 30 in long lower left section B 24 in long lower right section A 12 in long

tions to the arm or leg It is made of ⅜ in plywood 3½ in wide, with an expanded head end The combined splint (Fig 17) which will fit either arm or leg, consists of three sections *A*, *B* and *C*, 12, 24 and 36 in in

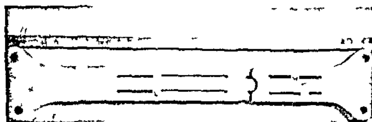


Fig 18

length, respectively *A* and *B* form an arm splint, *B* and *C*, a leg splint

The splint has double slots and bolts with wing nuts to adjust it quickly and firmly to different lengths and angles The broad headed end acts as a means of fixation, as a spreader for a traction sling, to prevent rotation of the extremity and for patient contact It may

(5) J Maine M A 33 0 November 194

be applied to the outer or inner side of the leg and reversed for injuries about the ankle joint When fixed traction is indicated, the outer splint is preferable and may be extended to reach well above the hip and below the foot

Section *B* alone makes a good inner arm splint, and sections *A* and *B* form an arm splint that is easily adjusted for length and also for any desired angle at the

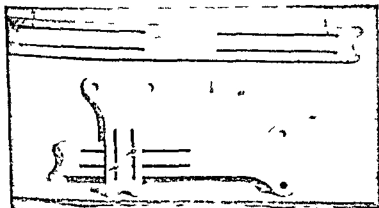


Fig 10

elbow To stabilize the splint fixation bands from holes in the head end cross over the shoulder and are tied under the opposite shoulder

G E Dunkerley[6] recommends *celluloid splints* because they are light durable washable, easily removed and replaced and fairly cheap Conditions for which he suggests their use are convalescent stage of poliomyelitis, quiescent stage of bone and joint tuberculosis and certain fractures, such as those of the carpal scaphoid, which require prolonged immobilization There are three stages in manufacture of celluloid splints

PROCEDURE —1 The preliminary plaster shell is made by applying circular plaster bandages to the limb in the desired position Two lead strips are used under the plaster, so that the shell can be cut off easily with no danger of injuring the

(6) Indian M Gaz 77 131 134 March 194

patient Correct apposition of the halves is insured by marking the shell with circular pencil lines before splitting it and making the ends of these lines coincide when rebandaging the halves

2 The shell is then filled with plaster or cement After drying for two or three days, the shell is removed and the cast made smooth by filing and applying plaster cream, so that the final splint may be smooth to the skin and not too tight

3 The celluloid splint consists of butter muslin impregnated with celluloid The latter is obtained from inflammable, discarded x ray films, cleaned free from emulsion and dissolved in acetone to make a saturated solution This solution is painted on the muslin as it is rolled on the cast. The bandaging must be even and, when each layer is completed, a couple of additional coats of the solution are applied to make an even homogeneous layer Thirty layers of muslin are used to form the splint, which is then cut in half and removed from the cast The inside is cleaned and made smooth by further coating of celluloid solution, and ventilation holes are drilled The edges are bound with leather, the halves joined by leather hinges at one side and straps and buckles at the other, and the splint is ready for use

Francisco Pablo Giordano[7] is trying *glass dressings over wounds*, both operative and those which heal by second intention He has used concave glasses of various sizes and shapes, provided with small lateral perforations for ventilation Fixed in place by strips of adhesive plaster, they allow inspection of the wound, save dressing materials spare the patient the pain which accompanies change of dressings and apply the principle of rest to wounded tissues Results have been satisfactory

[Transparent plastic material would probably be better than glass —Ed]

Kenneth L Pickrell[8] recommends the *use of a sulfonamide film as a surgical dressing*

TECHNIC —An emulsion is prepared containing 3 per cent sulfadiazine or sulfanilamide 2 5 per cent methyl cellulose, 3 per cent triethanolamine and 0 5 per cent sorbitol, with 50 per cent alcohol or acetone added to make 100 cc The emulsion is sprayed on a smooth, horizontal glass surface with a

(7) Semana méd 49 928 929 Oct 15 1942
(8) Bull. Johns Hopkins Hosp 71 304 306 November 1942

pressure gun or paint spray apparatus and allowed to dry When acetone is used as the drying agent evaporation is rapid, but when 50 per cent alcohol is used several hours at 75 C are required for drying before the film can be easily removed in a single sheet The sheets can be made in any desired size, are stable and can be sterilized by dry heat Ordinarily they contain 35 50 per cent sulfonamide When a segment of film is placed beneath the skin of a rabbit, absorption takes place and disintegration of the film is almost complete at the end of 24 hours

Pickrell has used these films in over 100 cases, about 50 of which were cases of burns They also served to cover recent incisions, lacerations and abrasions, to prepare granulating areas for grafting, to cover the recipient and donor areas at the time of grafting, to cover ulcerated areas and as a framework to hasten closure and regeneration of perforated ear drums

In 30 cases in which films with the aforementioned sulfonamide content were used for burns and in which bacteriologic studies were made, no infection was encountered, in the remaining cases there was no evidence of infection on inspection of the wounds When low concentrations of sulfonamides were used, infection occurred Sulfadiazine films offer a greater measure of local protection against infection than sulfanilamide films

Arthur D Ecker[9] (Syracuse Univ) presents a preliminary report on a *new skin varnish for maintaining sterility of operative field* The substance is a cellulose product dissolved in a mixture of ether and alcohol It is self sterilizing and when sprayed or painted on the skin forms an impervious coating insoluble in water Unlike collodion, it can easily be redissolved at the end of the operative procedure The preparation is chemically inert and does not react with iodine or other common antiseptics It is noninflammable, nontoxic, nonexplosive, nonirritating and does not interfere with healing of wounds or with making an incision It merely

(9) Surgery 12 631 634 October 194

provides a coating over the skin of the operative field so that organisms in skin excretions are not wiped into the wound Its value has been confirmed by bacterial counts from human abdominal skin under conditions similar to those of laparotomy Practical value in preventing postoperative infection will have to be judged from its use in a large number of operations with suitable controls

Eldridge Campbell Arnold Meirowsky and Victor Tompkins[1] (Union Univ) studied the alloys *ticonium*



Fig 20 —Drum rolled while cutting (Reference p 61)

wrought vitallium and ticonium cast with special reference to their use as cranioplastic materials in dogs Ticonium wrought and vitallium were found to be inert Ticonium cast (with beryllium) was found to be cytotoxic It is suggested that this toxicity is selective

Fibroblast cultures and electrolytic measurements are inferior to histologic studies as tests for the toxicity of metals The importance of carrying out in vivo studies

(1) Ann Surg 116 637 5 November 1942

for periods longer than six months is indicated by the late toxic reaction with the ticonium cast material

The wrought alloy ticonium appears worthy of trial as a cranioplastic material in man

George Warren Pierce[2] (San Francisco) considers *the Padgett dermatome* the greatest contribution in many decades to the technic of *skin grafting* Grafts, 4½×8 in can be taken at any desired uniform thickness, calibrated to 0 001 in Of special value is the ability to take grafts from any uneven surface, such as the chest, abdomen or back, greatly widening the choice of donor areas



Fig 1—Healed burns of both legs Large individual grafts readily discernible nine weeks after grafting

The deep intermediate graft of Padgett, cut with his dermatome measures 0 022 0 030 in, relatively 75 per cent of the full thickness of the skin In appearance and protection value it approaches closely full thickness skin which measures 0 032 0 045 in and is ideal as a covering However, percentage of take is so variable and difficulty of management so great that full thickness skin has only limited application The donor area must be closed surgically, while that of the deep intermediate graft heals spontaneously in about two weeks Since the split graft or deep intermediate

(2) California & West Med 5 10 18 July 194

type is selected for grafting almost all raw areas, and since both can be cut with this machine, it has become indispensable to the reconstruction surgeon

Alejandro J Pavlovsky and Mario M Harris[3] (Buenos Aires) report the first two cases of *free skin grafting* in which they have used *Padgett s dermatome* The first patient had lost an area of skin of the inner aspect of the right thigh 7 fingerbreadths wide and extending from 1 fingerbreadth above the condyle to 5 fingerbreadths below the inguinal fold Two grafts, 0 5 mm thick, were taken from the abdominal wall to cover the defect The second patient had a fibrous, retractile scar of the infrahyoid region resulting from a second degree burn The scar was excised and the defect, 10×5 cm covered with a graft, 0 6 mm thick, taken from the external aspect of the left thigh The final result was satisfactory in both cases

Beverly Douglas and Ransom R Buchholz[8] (Vanderbilt Univ) studied the *efficiency of the circulation of double and single pedicle tube flaps* in dogs (by which is meant the ability of the vessels to function in such a way as to maintain tissue viability at the other end) by use of four physiologic or functional tests (1) measurement of blood pressure (2) growth of hair, (3) rate of return of temperature after constriction, and (4) viability or ability to survive after surgical transfer

By using specially designed miniature cuffs and thermocouple needles in the flaps their pressures were measured and found to increase with the time interval after their formation until, at two months they were 90 95 per cent of normal femoral pressure In a single ended pedicled human flap the pressure reached 50 per cent normal brachial blood pressure in two months Growth of hair is moderately retarded on pedicle flaps up to three weeks after their formation, which seems to indicate a temporary slight disturbance of circulation

(3) Semana méd 48 709 713 Sept 24 1942
(8) Ann Surg 117 692 709 May 1943

Using the Brooks thermocouple apparatus, the "temperature return test" indicates an increasing circulatory efficiency from the time of formation of the flap until the sixth or seventh day in dogs, when the circulation through either pedicle to the other end appears to reach almost maximal efficiency At this time safe transfer of a pedicle may be accomplished

In dogs and man, curves indicating the efficiency of blood circulation in flaps have been correlated with the ability of the flap completely to survive surgical transplantation

Evidence accumulated from human cases appears to indicate the advantages of this physiologic test in individualizing the circulatory efficiency of the flap so as to save time between stages and to avoid discomfort for the patient incident to well meant but unnecessary delays In war surgery the importance of this point is obvious The magnitude of the time saving is to be determined as further cases accumulate

In a symposium[9] Charles Little Dunham and Hilger Perry Jenkins (Univ of Chicago) report on the possibilities of the presence of a *tissue irritant in the tubing fluids of surgical catgut* which, if carried into the tissues along with the gut, could explain many of the reactions observed They studied the anhydrous liquids used for boilable gut and the alcoholic solutions used for non boilable gut

Xylene, the anhydrous liquid commonly used for boilable gut, was found to be a potent tissue irritant

The alcoholic solutions used for nonboilable gut were found to contain in many instances a water insoluble liquid, the presence of which could be demonstrated by addition of water which produced a white emulsion The amount of this water insoluble liquid varied in different products, package lots and individual tubes in the same package, from a trace to 15 per cent by volume of the alcoholic solution

(9) Ann Surg 118 269 304 August 1943

Its irritant action is generally in excess of that observed for 95 per cent ethyl alcohol, but less than that found for xylene The magnitude of irritant action, which in some products was rather excessive, was proportional to the amount of water insoluble liquid in the alcoholic tubing fluid

The water insoluble liquid recovered from the alcoholic solutions by emulsion separation or distillation was somewhat more of a tissue irritant than xylene It probably represents a residuum of the anhydrous hydrocarbon used for heat sterilization of the catgut which was not eliminated from the tube before addition of the alcoholic solution and sealing the tube

The irritant action of xylene and of this water insoluble liquid which was probably hi flash solvent or a similar or related anhydrous hydrocarbon, raises the question whether these liquids alone or in combination with alcohol may not be carried into the tissues along with surgical gut in sufficient concentration to have an undesirable irritant action on the tissues in which the catgut is placed

Use of an anhydrous liquid in the heat sterilization of catgut to obtain uniform transmission of heat without damage to the gut is conceded as a necessary step in the manufacture of surgical gut to insure the standard of sterility expected by the profession However, it would appear that general improvements could be made in some manufacturing methods from the standpoint of utilizing a liquid for heat sterilization which is nonirritating to tissues or of eliminating from tubing fluids hydrocarbons which have properties irritant to living tissues

Albert E Sidwell Jr (Chemical Laboratory A M A) made a chemical examination of marketed specimens of nonboilable surgical gut from nine different manufacturers and found up to 14 per cent (V/V) of high boiling aromatic *hydrocarbons in the tubing fluids* These hydrocarbons are related to a coal tar distillate

which is known as the xylene fraction or solvent naphtha

Jenkins and Dunham found that the amount of irritant water insoluble hydrocarbon from tubing fluids, which in ordinary operating room technic may be carried into the tissues along with surgical gut, is adequate to explain a substantial part of such tissue irritation as has generally been attributed to properties of the catgut itself Presence of alcohol in the gut from nonboilable tubing fluid or from washing procedures for boilable gut probably contributes in part to such irritation

From the standpoint of obtaining optimal wound healing in surgery, it is obvious that introduction of tubing fluid irritants into the tissues along with suture material is not in the best interests of the patient or the surgeon Elimination of tubing fluid irritants from surgical gut should result in generally better clinical results with use of absorbable suture material

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MILITARY SURGERY

War Wounds—*Reduction in Fatalities*[4]—The remarkable advances in medicine and surgery since World War I are now saving the lives of soldiers wounded in combat Outstanding discoveries contributing to this are the sulfonamides blood plasma and new anesthetics It is still too early to get a detailed picture of results in treating the wounded of the present war, but definite indications of improvement in wound fatality rates are available from scattered sources Preliminary data on U S Army casualties up to December, 1942, show 4 104 wounded, of whom 156 died a fatality rate of about 4 per cent Gross fatality rate in the American Army in World War I was 7 7 per cent, and in the British Army on the western front 7 6 per cent Limited experiences which may be cited are a gross rate of 3 8 per cent in a large medical unit at Pearl Harbor in December,

(4) Stat Bull Metropolitan Life Insur Co 24 1 2 February 1943

1941, and less than 1 per cent among Navy and Marine casualties during the first three months of fighting in the Solomons in 1942

As to specific sites of injury, mortality from abdominal wounds in previous wars has usually been higher than 50 per cent, and much higher for certain types of such wounds In the Solomons fighting it was less than 5 per cent Mortality from wounds of the chest cavity, which in former wars often exceeded 25 per cent, was reduced in one British medical unit to about one fifth of that figure among such casualties evacuated from Dunkirk Similar accomplishments by the medical services of the Russian Army have also been reported

Wound infections and gas gangrene are relatively infrequent, largely as a result of the routine use of sulfonamides, and tetanus has been practically eliminated by routine protection with tetanus toxoid Shock and hemorrhage are now successfully combated by use of plasma and sedatives in the field With the new methods of treating burns, recovery is frequent even from extensive lesions which previously were usually fatal

Urban Maes[5] (Louisiana State Univ) states that in *war surgery* shock hemorrhage and infection are the fundamental considerations, one having a thorough knowledge of these three entities is fairly well equipped to take care of most injuries

The first concern in all battle casualties is shock Two phenomena are responsible for all its manifestations oligemia and associated anoxia They are present whether shock be due to a burn compound fracture or visceral injury Plasma transfusion is the most important single measure to be used in any signs of shock It might be feasible to have every soldier act as his own donor almost every inductee could supply 500 cc blood, the plasma of which could be lyophilized and stored or carried in a small container Adequate sup

(5) Tri State M J 15 28 0 2823 November 1942

plies of plasma, preferably dry, should be on hand at all times so as to be prepared for any eventuality

While Maes has treated many battle casualties, care of active bleeding has not been a serious consideration Hemorrhage has usually been fatal or stopped before first aid could be administered If bleeding is a consideration, the first aider should be familiar with use of the tourniquet and direct pressure Too little emphasis has been placed on the second method Ligation at the bleeding point is the ideal method but is not generally practicable outside a hospital Internal hemorrhage will always take its toll unless the patient can be transported to a properly equipped hospital in time In air raids, the wounded must be cared for just as soldiers are in combat

As to infection, it may be difficult to decide whether amputation is more desirable than a prolonged period of painful dressing with possible failure in the end Recognition of the predominating type of infection may help make the decision It is interesting that no gas gangrene was recorded from Pearl Harbor, despite the fact that many wounded were grossly contaminated with dirt that should have introduced the anaerobes Several possible explanations include prompt hospitalization, free use of sulfonamides, wearing of cotton clothing, few if any primary wound closures after debridement Thorough mechanical sterilization and placing sutures without tying them until it is evident that no infection is present would seem to be a wise standard to enforce

Treatment of battle casualties must depend on the time element, stress of battle and equipment at hand Collection and transport therefore head the list in importance, and this is also true in civilian casualties whose wounds are due to all sorts of debris which must be potential sources of infection

Treatment of burns should be divided into care of the patient and care of the burned surface A burn is simply a wound of a special type Cleanliness and immobilization are important Dressing of an extensive

burn is always painful and can produce more shock In many instances, Maes has used no dressing after primary cleaning of the burned surface The patient was kept in a heat tent with regulated temperature and dusted with sterile talcum For restoration of circulatory balance the sheet anchor is plasma For pain relief, morphine is sure The individual should be treated first the burn second Any sensible wound dressing will suffice

[Perhaps too much emphasis is being placed on plasma and not enough on whole blood When a patient has had a severe hemorrhage he will certainly be restored more quickly by red corpuscles plus plasma than by plasma alone The problem however of supplying whole blood in the combat zone is of course much more complicated than that of supplying dried plasma —Ed]

C A M Renou[6] (M C R A A) discusses *treatment of war wounds of the abdominal viscera and results obtained at a forward operating area in the Middle East* An Australian general hospital was almost overtaken by the fighting and became the medical unit of an invested garrison In 4½ months the number of patients with wounds involving the abdominal viscera was 72 Of these, 34 died and 38 were eventually evacuated to a base hospital, the mortality rate being 47 per cent Because of the nearness of the hospital to the front line, most patients were operated on early usually within six hours of injury

The patients could be placed in four groups (1) those whose condition was so good that immediate operation was possible, (2) those with pronounced shock hemorrhage syndrome in whom resuscitation was necessary before operation, (3) those with marked evidence of internal hemorrhage (4) those with peritonitis on admission

Despite their good condition patients of the first group were as a rule placed in the resuscitation chamber warmed and given morphine while the theater was being prepared for operation In the second and

(6) Australian & New Zealand J Surg [illegible] 139 October 194[illegible]

third groups, the resuscitation period was of necessity longer, blood transfusion was instituted without delay and continued by the slow drip method in the theater during operation Patients falling in the fourth group were few On the way from the resuscitation chamber to the theater all patients, except those with single through and through revolver, rifle or machine gun wounds, were examined with the screen The foreign body was localized and the skin marked in two planes Roentgen films of the abdomen were taken only when the foreign body could not be easily seen under the screen

The anesthetic of choice was ether given by the open method, following induction by ethyl chloride, chloroform and ether mixture or, in certain cases, ether alone Gas and oxygen failed to produce sufficient relaxation of the abdominal musculature Local anesthesia was adopted in a few selected cases with satisfactory results

Preparation of the skin was delayed until the patient had reached the theater and generally until he had been anesthetized It consisted of shaving, washing with soap and water and application in turn of benzine, spirit and 2 per cent iodine in spirit

When the wounds of entry and exit were in the abdominal wall, they were dealt with before laparotomy was started Small gunshot wounds remained untouched in most cases and were dressed with sulfanilamide powder and vaseline gauze All other wounds were excised down to the peritoneum and in some cases sutured When drainage was necessary, the tube was introduced into the abdominal cavity through the excised wound When the wound was posterior (i e in the buttock) it was freely excised remained unsutured and was dressed with sulfanilamide powder and vaseline gauze This procedure rendered all further turning of the patient unnecessary

During laparotomy, in all cases the alimentary canal

was carefully inspected from stomach to rectum before any repair was carried out As each gut perforation was exposed it was clamped, and, after complete inspection, repair by suture or *resection of the injured area* was performed In cases in which hollow viscera were injured, after treatment, with few exceptions, consisted in adequate sedation (morphine), withholding of food or fluid by mouth and use of continuous intravenous drip therapy (5 per cent glucose saline solution) Sulfanilamide was given by mouth or, if vomiting was at all pronounced, by the intramuscular or intravenous route The mouth was washed out at frequent intervals, but no fluid was *allowed* to be *swallowed for at least* 48 hours after operation Intravenous administration of saline solution was continued until all vomiting had ceased and the patient had taken fluid by mouth for at least 24 hours without ill effect When vomiting persisted after the patient had recovered from his anesthetic, a Rehfuss tube was passed nasally and the stomach kept empty Aspiration through this tube was maintained until the return showed no trace of color *On one occasion it was not removed until the sixth day*

No patients were evacuated until they were fit to travel 250 miles by ship to a base hospital between the tenth and the twenty first day

The mortality for wounds of the stomach was 88 per cent, of the small intestine 69 per cent, of the colon 60 per cent of the rectum 100 per cent of the bladder 40 per cent, of the kidney 22 per cent, of the liver 14 per cent and of the spleen 33 per cent

According to Roger Smith,[7] *cannon shell injuries* are likely to form a high percentage of the casualties admitted after a raid by low flying airplanes Cannon shells consist of a nose piece surrounding a charge of explosive and a metal cap fitted over the base (Fig 22) *The bore is about 1 in and the velocity 3 000 ft* per second Such a missile is likely to cause a host of differ

(7) Lancet 1 175 176 Feb 6 1943

ent injuries, but with at least two exceptions they are similar to those found in casualties from bombing raids

One exceptional type of injury is described as a theoretical possibility in the etiology of a dangerous form of penetrating wound The cap has been found in the tissues as a foreign body in five casualties resulting from hit and run raids After disintegration of the nose piece, the cap continues to go forward with considerable velocity, as shown by its depth of penetration into the tissues Between the moment of disintegration of the shell and impact with the body, the cap takes the form of a flat disk like missile with no stream lining, carrying before it therefore a zone of compressed air and the remnants of the recently exploded charge between it and the nose piece The cap, on impact with a clothed limb, for instance, may carry in clothes to the greatest depth then gunpowder and air under pressure, the cap itself acting as a plug and preventing the escape of air back along the track In four of the five cases so far seen removal of this plug has been followed by a small cloud of smoke smelling strongly of gunpowder, and deeper exploration has revealed pieces of clothing buried within the wound

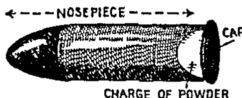


Fig 22

This concept of air being carried in under pressure has been criticized, but seems to be correct The zone of high pressure is due entirely to the shape of the cap and naturally is not found to the same extent in the thin tapered machine gun bullets, fragments of bomb shrapnel or pieces of glass The cap is made more dangerous still by its high velocity, jagged rim and the presence of the recently exploded powder in front When it finally comes to rest in the tissues, the condition at the site of lodgment is one of air and gunpowder plugged

in by the cap and partially surrounded in its deepest aspect by skin organisms, dirty clothing and contused muscle

The dangerous potentialities of *this type of wound* are obvious In addition to damage to vital structures, the air carried and plugged in by the cap decompresses itself into the tissues Muscle planes opened up by the missile are infiltrated by the air, either as an intramuscular blast or as a slow leak Interstitial surgical emphysema arises and in some cases, later an anaerobically infected surgical emphysema

Gas gangrene may have its origin in the infected surgical emphysema As in other wounds, the dangerous areas would be the legs thighs and buttocks If events follow this course treatment of the wound is needed urgently It should be excised earlier than wounds *from* other missiles and the excision should include the widest limit of the air in the tissues The limb should be moved as little as possible before operation so as to delay dispersal of the air

The second type of exceptional injury is that due to an unexploded shell embedding itself in the tissues The injury is a curiosity but is not unique In addition to the uncertain behavior of the shell its size and velocity are sufficient to cause extensive injury Removal of this foreign body is imperative There is also a possibility of phosphorus contamination from the incendiary type of shell Presumably if a blunt nosed truly high explosive shell is present, it must be a dud Only very hard impact will explode the sharp nosed, armor piercing type so that the danger of their removal is negligible The blunt and sharp nosed shells are easily differentiated by roentgen rays

To remove any possible misunderstanding on *the question of excision and suture of wounds in war surgery*, Hugh R G Poates[8] (Sydney) presents the conditions necessary for success with this procedure

(8) Australian & New Zealand J Surg 1? 143 146 October 194

It should not be attempted by any but a skilled surgeon. An operating theater must be available where strict asepsis can be maintained by a staff of competent assistants. The patient should be received within eight hours at most from the time of being wounded. When there has been extensive damage to or loss of soft tissues the procedure should not be attempted. Thorough excision of all damaged or devitalized tissue must be practiced and absolute hemostasis obtained. No buried sutures should be used other than to close serous membranes. Suturing should be done with unabsorbable material, deep bites being taken in the tissue and the sutures being tied without tension. If sulfanilamide powder is available, the wound should be dusted with it before being closed. If there is any doubt at all as to closure, it is wiser to use sulfanilamide and to cover the wound with vaseline gauze. Never pack wounds tightly. Because of the impossibility of securing the complete excision mentioned, this technic is not to be used in the presence of comminuted fractures.

Whether recent wounds are sutured or not, the importance of excision or débridement cannot be stressed too highly, as the result depends on control of sepsis.

Trueta, in discussing the closed plaster technic, goes so far as to state that "the keystone of the whole technic on which success ultimately depends" is proper excision and that without it the technic is worthless or even dangerous.

W. Ruckert[9] considers *origin and treatment of delayed hemorrhage due to gunshot wounds* on the basis of 35 relevant cases selected from 300 to 400 wounded. Hemorrhage due to sepsis was insignificant. Two important types of delayed hemorrhage were recognized. (1) In 26 patients hemorrhage occurred within three or four weeks of injury, but not, as a rule, during the first five days. Maximal incidence was between 10 and 15 days. Hemorrhage was always associated with pri

(9) Deut. Militärarzt. 1G: 18, March 1941.

mary injury to a large artery caused by penetrating wounds (rifle bullets or splinters of mines, grenades or bombs) Twenty were through and through wounds In all these cases an "encapsulated fibrin body" (false aneurysm) formed at the site of injury to the vessel Hemorrhage occurred only after blood pressure had risen high enough to burst open the wall of this body Two patients died before operation Of the 24 operated on, 19 survived The false aneurysm was dissected free and excised after the vessel had been secured above and below The artery was reconstructed in two cases Concomitant venous hemorrhage was also secured (2) In nine hemorrhage occurred between the fourth and the eighth week, with highest incidence in the fifth The cause was vascular erosion by bone or bomb fragments or by drainage tubes

Using *experimental wounds* in rabbits Frank Hawking[1] studied the proposal that when battle conditions make excision of wounds impracticable the wounds should be *filled with* some semifluid preparation of a *sulfonamide* and then covered with an occlusive dressing to prevent exogenous infection

It was found that persistence of the sulfonamide in a wound could be prolonged by incorporating sulfanilamide in an oily medium or by using a less soluble sulfonamide such as sulfathiazole or sulfapyridine Therapeutically (i e prevention of streptococcic septicemia) the best results were obtained with a 20 per cent preparation of sulfathiazole consisting of micro crystals suspended in saline with sulfanilamide which is more soluble and more rapidly absorbed results were better with oily than with aqueous preparations

Histologically oil in the wounds caused undesirable tissue reactions Of the oils tested, cod liver oil was especially bad liquid paraffin moderately bad and cotton seed oil the least harmful The best preparation was the microcrystalline preparation of sulfathiazole

(1) Lancet 0 ·10 Oct. ·1 194?

Judging by reports from the Middle East Forces, sulfonamide dressing of a wound is inferior to excision. Since, however, surgery is often impracticable, dressing the wound with a semifluid sulfonamide preparation would be advantageous in restraining bacterial growth until more elaborate treatment is feasible; under these circumstances, the best preparation would be the microcrystalline suspension of sulfathiazole or, failing that, a 30 per cent aqueous preparation of sulfanilamide.

[Positive evidence of the value of local applications of sulfonamides in preventing wound infections is still lacking.—Ed.]

Proflavine powder has been used by G. A. G. Mitchell and G. A. H. Buttle[2] (R.A.M.C.) in 80 cases of *intractable wounds* with beneficial results in almost every case. When staphylococci are the infecting organisms, proflavine has proved more efficient in controlling and eliminating infection than any other drug, and many mixed infections have also responded well. With possible exception of one case, no interference with healing has been noted. The drug is much less toxic than acriflavine. Most patients find the dressing painless, and no general toxic manifestations have been observed.

The amount of proflavine used therapeutically has never exceeded 2 Gm. in any one case, and was usually only about 0.5 Gm. or less depending on size of the lesion. It was introduced into cavities with a small Volkmann scoop or the end of a blunt dissector, or in an extensive wound it was dusted over the entire surface and evenly distributed with a spatula or scalpel handle. It was never used on more than two or three consecutive occasions, 4-28 days elapsing between applications. Used prophylactically, the amount varied according to size of the lesion, but was usually about 0.25 Gm. mixed with 2.5 Gm. powdered sulfanilamide. The two drugs have seldom been combined in treating

(2) Lancet 416-419, Oct. 10, 194

established infections The drug used throughout was proflavine sulfate (2 8 diamino acridine sulfate)

From the prophylactic aspect, it is impossible to assess the relative value of proflavine and sulfanilamide because the two drugs have always been used together and then only as an adjunct to surgical measures Therefore for prophylaxis sulfanilamide should always be preferred Until there is further evidence as to its effect on healing proflavine should not be used as a prophylactic agent except in small doses (0 25 Gm or less), *such small amounts may be sufficient to prevent* staphylococcic infections

[The frequently expressed enthusiasm for the local use of various antiseptics in this war should be compared with the equally great enthusiasm expressed for the use of Dakin s solution in the last war —Ed]

R A Money and T Y Nelson[1] (M C, A A) review their *experiences with battle wounds of the head* They treated 78 patients at a neurosurgical center between July and December 1942 during the fighting in the vicinity of El Alamein in 25 there had been penetration of the dura mater The cases could be classified into six groups scalp wounds wounds of the skull without depression of fragments wounds of the skull with depression of fragments but without penetration of the dura wounds of the skull and brain with penetration of the dura perforating or through and through wounds and penetrating or perforating wounds through the orbits, accessory nasal sinuse and mastoid air cells

The authors conclude that if a soldier with a wound of the head is unable to survive the first 12 hours he is unlikely to live irrespective of what is done for him thus urgent surgical intervention is rarely necessary except in meningeal hemorrhage rapidly spreading subdural hematoma or severe arterial hemorrhage from the scalp *The thoroughness of the initial examination and toilet of the wound is more important than the time*

(1) Ann Surg 118 1 33 July 1943

factor, at least up to four days as long as prophylactic sulfonamide therapy is maintained during the period of waiting

Surgeons with field surgical units must have a knowledge of neurosurgical technic and be provided with adequate facilities if this class of wound is to be correctly dealt with in forward areas Under conditions existing in Middle East, it is better to stabilize these facilities at a place where the patient can be "held" after operation, and so arrangements should be made to transport the patient back as rapidly as possible, preferably by air ambulance to a special center An alternative plan is the provision of a field surgical unit with operating place and beds entirely on wheels which could keep pace with the advancing or retreating troops or be replaced by another similar unit when its accommodation was filled

The removal of indriven bone fragments and inorganic debris is more important than the extraction of metallic foreign bodies Even minute missiles making a small wound in the scalp and outer table of the skull, are likely to drive large comminuted pieces of the inner table deeply into the brain and cause more extensive damage than the size of the missile and the condition of the patient would indicate Closure of the tear in the dura mater should be attempted to prevent formation of cerebral hernia cerebrospinal fluid fistula and aerocele Signs of unilateral local and focal damage to the brain do not call for extensive operations if there are no signs of compression but should be recorded from time to time by observers trained in neurology

The actual concentration of sulfonamide in the cerebrospinal fluid of every patient varies with the same dosage and must be checked at frequent intervals by colorimetric methods to make sure that adequate concentration is attained and maintained in case of intracranial infection The advent of the sulfonamides, especially sulfadiazine has altered the outlook for wounds of the head entirely and none should ever be despaired

of, however badly infected and however serious the complications, nor can the final result be predicted

Something further could be accomplished in prevention of wounds of the head and subsequent infections by (1) provision of a more modern design of steel helmet which would fit closer and lower down over the frontal, temporal, mastoid and occipital regions and which would hinder the entry of rising foreign bodies from explosives which burst on the ground, (2) issue of a general order that all troops should have the hair of the scalp closely cropped before going into battle, and (3) distribution to every soldier, to keep with his field dressing, a standard dose of sulfapyridine or sulfadiazine, 4 or 6 Gm., with instructions to take it or have it given to him by a stretcher bearer as soon as possible after being wounded This would be an effective prophylactic for the next 12 hours

C P Symonds and W Ritchie Russell[3] (R.A.M C) have collected data on military *head injuries due to accidents* of a kind which may also occur in civil life Cases admitted to their hospital are divided into two groups (1) chronic cases previously treated in other hospitals, many of which were transferred because progress did not come up to expectation, and therefore forming a highly selective group, (2) acute cases, a relatively unselected group usually, but not always, admitted because the accident happened in the vicinity of the hospital Patients admitted within three weeks of the injury are included in the acute group

Of 242 consecutive patients with acute head injury among service personnel, 91 per cent of those who survived were returned to duty and 9 per cent invalided A further 11 per cent were invalided later A long post traumatic amnesia carried a relatively poor prognosis for return to duty Analysis of those returned to duty and followed up showed that in 90 per cent the duration of treatment (including rehabilitation) was less

(3) Lancet 1 7 10 Jan. 9 1943

than three months and that there was no difference in the length of treatment for those who relapsed and those who remained well

Prognosis for return to duty for 718 patients with chronic head injury was more than twice as bad as for the other group This did not depend on more severe injury, as judged by the duration of post traumatic amnesia There is a correlation between the poor prognosis in this group and a higher incidence of predisposition to mental disorder

In 111 cases of acute and chronic head injury in personnel of the R A F, prognosis for return to duty was four times as good as in all the other cases of the series The main reason for this probably was that the flying personnel is a highly selected group with regard to absence of predisposition to mental disorder This is supported by a low incidence of such predisposition, as determined in this investigation

K Denecke[4] recommends use of *plaster of paris splints in postoperative treatment of gunshot fractures of the limbs* The plaster is applied rapidly, but the method must be simple enough for semiskilled persons The plaster must be firm yet not too heavy This is achieved by placing slabs where the greatest strain is expected Good padding is necessary Windows over the wounds must be as wide as possible, i e, about one third of the circumference of the limb Edema must be avoided These plasters are for transport purposes only and as a rule are removed within a week, consequently, position of the fragments is not considered Dressings under the plaster should be secured by an adhesive substance and not by a circular bandage, so that they can be changed through a window Plaster splints may be kept in position by a circular plaster bandage until they have set, then the circular bandage may be cut longitudinally and replaced by an elastic bandage of some sort, e g, crêpe

(4) Munchen med Wchnschr 89 3 3 328 Apr 10 194?

Shoulder spica for upper arm or elbow fractures The padding on the chest and shoulder is fixed with a couple of plaster bandages Three slabs are used, 120 cm long, 12 cm wide and seven layers thick, made of ordinary plaster or cellona Slab 1 starts in the axilla of the unwounded side and passes over the front of the chest obliquely to the shoulder of the wounded side Slab 2 starts in the same place but is carried over the back to the affected shoulder These two form the upper border and strut of the spica and are continued down the arm on the opposite side of the arm to the wound (i e extensor aspect for a flexor wound and vice versa) the borders of the slabs being contiguous If the elbow is included in an extensor wound they cross each other in front of the elbow and in the forearm they pass more to the ulnar aspect Slab 3 begins in the posterior axillary line and sweeps

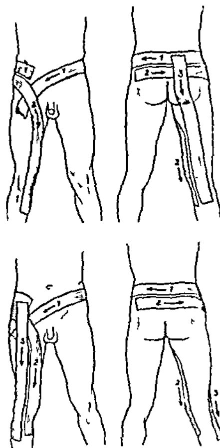


Fig 3

over to the affected side forming the distal border of the spica, it is then stuffed in the gap between the chest and the arm and continued down to the wrist The amount of abduction is only that required to pass a roller bandage between the arm and the chest or, in

the case of wounds on the posteromedial aspect to allow dressing of the wounds, furthermore, the slab is held far enough forward to be in slight elevation when the patient is lying on his bed

The slabs are covered with two plaster bandages to the trunk and arm The plaster immediately over the wound area is removed the slab edges around it are smoothed while still soft, and a dressing is applied If

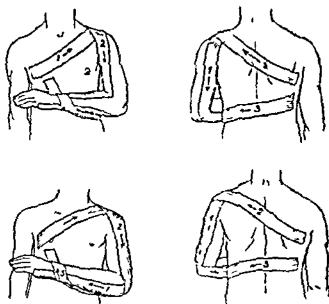


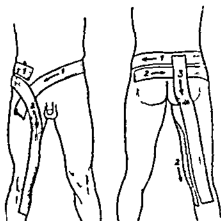
Fig 24

the window is large enough, edema is avoided Application of the plaster takes 10 minutes

Hip spica Adequate flexion of the hip and knee must not be overlooked The padding must be especially generous over the sacrum and should be fixed by plaster bandages 15 cm wide, well molded to the crest of the ilium The slabs should be 15 cm wide 1 4 M long and seven to nine layers thick (equivalent to five or six cellona bandages)

Slab 1 starts over the iliac crest of the affected side anteriorly and runs over the sacrum to the opposite

Shoulder spica for upper arm or elbow fractures The padding on the chest and shoulder is fixed with a couple of plaster bandages Three slabs are used, 120 cm long, 12 cm wide and seven layers thick, made of ordinary plaster or cellona Slab 1 starts in the axilla of the unwounded side and passes over the front of the chest obliquely to the shoulder of the wounded side Slab 2 starts in the same place but is carried over the back to the affected shoulder These two form the upper border and strut of the spica and are continued down the arm on the opposite side of the arm to the wound (i e extensor aspect for a flexor wound and vice versa) the borders of the slabs being contiguous If the elbow is included in an extensor wound they cross each other in front of the elbow and in the forearm they pass more to the ulnar aspect Slab 3 begins in the posterior axillary line and sweeps over to the affected side forming the distal border of the spica it is then stuffed in the gap between the chest and the arm and continued down to the wrist The amount of abduction is only that required to pass a roller bandage between the arm and the chest or in



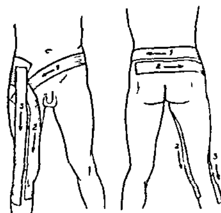


Fig 23

Army half ring splint and elastic traction fixed to the splint end The stump is secured to the side bars of the splint by bandaging

Repair of the guillotine stump is by plastic closure, plastic resection or reamputation Sulfanilamide or sulfathiazole should be used freely

[When Surgeon General Kirk discusses amputations he speaks from an extensive personal experience His book on this subject issued shortly after the last war is a classic —Ed]

R Zenker[6] discusses *diagnosis and treatment of gun shot wounds of the lung and pleura* He believes the first essential in lowering mortality is accurate treatment in advanced field hospitals

Important early dangers are (1) overlooking a chest wound in a patient in deep shock, (2) increasing hemothorax, (3) widely open pneumothorax, (4) tension pneumothorax, (5) mediastinal emphysema, (6) associated abdominal and thoracic injuries Assessing extent and progress of intrapleural bleeding is difficult but, if blood withdrawn by aspiration does not clot, it can be assumed that no fresh hemorrhage has occurred for five hours In explanation of this Zenker suggests that blood in the pleura evokes a serous effusion which dilutes it and that with movements defibrination occurs

Early treatment of hemothorax is aspiration and blood transfusion when necessary Reaccumulation of fluid after aspiration is generally due to pleurisy and not to recurrent bleeding Closed drainage with suction is indicated when effusion increases despite repeated aspirations, in massive hemothorax and if infection supervenes

Roentgen examination is valuable but not conclusive for diagnosis of hemothorax or as indication of need for aspiration Zenker's working rule is "Aspirate not too late not too little, not too infrequently, and don't delay intercostal drainage and suction too long" If as

(6) Chirurg 14 1 9 144 Mar 1 1942

iliac crest and then across the pubis to the affected leg Slab 2 begins at the hip of the unaffected side passes over the sacrum below slab 1, across the affected hip and down the thigh, it ends below the knee on that side, leaving the wound uncovered Slab 3 begins at the iliac crest and passes parallel to slab 2, but along to the foot This provides three pelvic struts and two knee struts The rest of the method is similar to that for a shoulder spica, with fixation of the slabs by plaster bandages and construction of windows as required

Notes may be written on the plaster Most patients treated in this way were transported without pain or ill effects

Amputations—Norman T Kirk (M C, U S A) states that the circular or flapless guillotine method is the simplest, quickest and easiest amputation for a badly shocked or critically ill patient The patient becomes transportable earlier without fear of infection, which too often follows the closed method It exposes less soft tissue area and affords adequate draining of infected bone and the closed muscle fascia spaces of the extremity thus limiting infection, and it affords a stump of maximal bone length that survived the original injury

Immediately following amputation, continuous skin traction must be applied with four strips of 2½ in adhesive, equally spaced extending to the margin of the wound and secured by two or more encircling strips The four ends are secured to a spreader through whose center passes a cord which runs over a pulley on the foot of the bed and is attached to a bag holding 6 8 lb of weight A piece of stockinet of proper size secured to the skin of the stump with "ace adherent" may be used instead of the adhesive Traction must be continued until the wound heals which in a thigh will require six weeks If the patient is to be evacuated, traction may be maintained by a Thomas or an

( ) J A M A 1 0 13 16 Sept 5 194?

Air Raid Injuries—The Committee on the Survey of War Medicine of the National Health and Medical Research Council[7] reports on *types of injuries to be expected* Total casualties in air raids are smaller than has been expected Fatal cases amount to 40 per cent of total casualties Penetrating wounds inflicted by bomb splinters are characterized by much more destruction of tissue than is at first apparent Injuries from flying glass are relatively common and sometimes serious Crush injuries from falling masonry, etc, are common and have introduced special problems "Blast" injuries to the lungs are not common Burns and scalds depend on type of area bombed, at times, incidence is high but, in the main, not so high as would be expected Injuries to head and neck make up approximately one quarter of all serious injuries Eye injuries are relatively common and special arrangements have to be made to deal with them Psychiatric cases are not nearly as common as was expected

Reception of casualties in an E M S hospital calls for a procedure different from that in peacetime These casualties are the immediate concern of several separate departments and therefore each section should be supplied with the necessary data in the simplest form Stanley J Firth and Harold Parl[8] (Municipal Hosp, Brighton) prepared an urgency admission sheet, the front page of which is reproduced (Fig 25) It is hung at the foot of the bed in a temperature chart holder Its back is divided into two sections one half for operative findings, the other for postoperative instructions This side is completed by the anesthetist during the operation

The surgeon in charge of a group of casualties makes his examination and in a few seconds completes the sheet giving provisional diagnosis instruction for radiography resuscitation procedures required and grading

(7) M J Australia (Supp 1) 1p 14 Oct 31 194
(8) Brit M J 401 49 Oct 24 194

piration fails to control bleeding in the early stages operation is needed to secure the bleeding point

In tension pneumothorax the treatment advised is to insert into the pleura an intercostal catheter, over the outer end of which a perforated finger stall has been tied For safety the end of catheter is kept under water

The most dangerous type of open pneumothorax is that in which the hole in the chest wall is larger than the lumen of the trachea Immediate treatment is to close the aperture with dressings and at the earliest moment suture the wound in layers without drainage Pleural drainage is indicated This treatment must be carried out even as late as 48 hours after injury

Mere suspicion of an abdominothoracic wound is indication for early operation Many patients are properly treated by laparotomy but sometimes combined thoraco abdominal approach is needed Incidence of serious empyema and postoperative atelectasis is high

If pleural secretion persists after three or four weeks, or if temperature rises when the drainage tube is removed a residual empyema cavity can be assumed, even if x rays do not show it Resection of a small piece of one rib is useless pieces of several ribs and the thickened pleura must be excised and the cavity then treated by prolonged suction drainage If the cavity fails to close extensive thoracoplasty is indicated If a large bronchopleural fistula is present at operation, wide skin and muscle flaps should be used

Bullets in the lung often heal in ' and as a general rule do not require removal unless serious complications such as lung suppuration or bleeding supervene Large fragments of shell may have to be removed early

[Any sucking wound should be closed promptly regardless of its size Although it is true that openings larger than the trachea are more dangerous than smaller ones the most important consideration is the vital capacity A very small opening may be fatal if the vital capacity is scarcely larger than the tidal air requirements Again a wound larger than the cross section of the trachea may not be immediately fatal if the patient has a high vital capacity —Ed]

preliminary treatment carried out Clerical work by the nursing staff is reduced to writing the name and age at the top of the sheet All other details required by the clerical department are obtained by its own staff

Foreign Body Locator—There has long been a real need for some device that would act in association with or independent of roentgen aid to *locate a foreign body* accurately prior to operative exposure and to determine its exact depth in the wound The device should give a

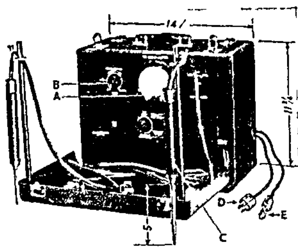


Fig 26—Appearance and dimensions of the locator

visible response on a dial or other indicator and become activated by fragments of iron, steel, copper, silver, aluminum, lead or their combinations The electrical source should be of the ordinary plug in type or come from a storage battery or dry cells Cost, size, sturdy construction and portability are also involved John J Moorhead[2] (New York City) now uses the *locator* (Fig 26), an apparatus fulfilling many of these requirements

APPARATUS—In size and shape it suggests a portable radio On the front panel are the dial (*A*) to record the proximity

(2) J A M A 121 123 125 Jan 9 1943

of cases for time of operation He also assesses the degree of severity, which indicates the procedure to the clerical staff

The other members of the team follow up and, taking red label cases first, carry out the ordered treat-

This Sheet to be issued to the Ward and used on admission of Casualty

Name of Patient Age
Date admitted Time a.m. p.m. Religion
Clerical Details recorded

CONDITION ON ADMISSION T P R B P 1 2 3

Signature when complete

PROVISIONAL DIAGNOSIS. Dangerously ill / Seriously ill / Slightly ill

IMMEDIATE TREATMENT Morphia
Radiant Heat
Intravenous therapy Blood / Plasma / Saline
A.T.S.
Oxygen
Catheter

X RAY

OPERATIVE TREATMENT
Required PRIORITY (red label) / EARLY (yellow label) / DELAYED (green label)
Not required

PREMEDICATION & ANAESTHETIC.

Examining M.O.' Initials.

Fig 25

ment which requires their personal attention, e g, intravenous therapy, blood pressure and hemoglobin estimations Treatment having been completed, the sheet is initialed Thus the surgeon is enabled to look through his own cases and proceed with operation, each patient arriving at the theater in the correct order and with

nant circuit of a high frequency oscillator Action of the foreign body is to decrease inductance of the search coil The frequency of the oscillator is mixed in a valve with the output of a second oscillator, and resulting beat frequency is made audible by a loud speaker The range of the probe increases with the diameter Two probes are therefore provided a thick one used at the beginning of the operation and a thin one worked in the immediate vicinity of the foreign body

The apparatus consists of a small metal case with amplifier and loud speaker Two switches are placed in front one for control of the oscillator frequency, the other for switching on and off and for volume control A switch on the side controls the probes The switches are detachable and can be sterilized by boiling so that the surgeon can work them himself The probes are connected to the set by 2 M cable The cable, probes and probe container are sterilizable only by antiseptic solution It is therefore advisable to cover the probes by sterile rubber fingers and the cable by sterile towels, to obtain complete asepsis At the back of the case is an arrangement of switches for utilizing available current voltage The apparatus can be connected with any alternating current lighting circuit or battery supply

Before operation the foreign body is localized by x ray When the patient is put in position, care must be taken that the foreign body is at least 15 cm from the metal support Otherwise it is advisable to put cushions on the metal sheeting of the table Metal clips for sterile towels must be at least 15 cm from the field of operation Should retractors be necessary, they must be made of porcelain

At the beginning of operation the apparatus is switched on and by adjusting the condenser a deep tone is produced which becomes constant in three minutes As the probe proceeds toward the foreign body there is alteration in pitch which becomes greater with closer approach to the missile The nature of the foreign body may have a diminishing or an increasing effect on inductance It is possible however, so to adjust the set that the pitch of the note is always increased as the foreign body is approached

If the foreign body is only a few centimeters below

of the object and a control knob (B) to regulate the sensitivity of the apparatus The probe or finder (C), the size and shape of a large fountain pen, is made of stainless metal or bakelite and is furnished with a sterilizable specially fitted rubber sleeve for search within the wound The plug in wire (D) is like that of any radio A 20 ft ground wire with spring clip terminal (I) serves to eliminate body capacity effects and static charges

TECHNIC—The probe is passed over the suspected area and as it comes closer to the metal particle the needle moves higher on the dial scale until the point on the surface is found which gives the highest reading This gives the skin location and to some degree denotes also the size and composition of the metal To know the subsurface depth, Moorhead selects a piece of metal of the same composition and approximate dimensions as shown on the x ray and approaches the probe with it until the dial reading is the same as that noted for the surface location on the patient's body Distance between test object and probe equals subsurface depth

If when the incision is made the foreign body is not immediately discovered the probe (covered with its sterile sleeve) is placed in the wound and moved lengthwise with respect to the incision to a point at which the highest reading is obtained Then the probe is pressed against each of the two walls of the incision in turn to determine by the higher of the two readings which wall contains the foreign body It is then slowly raised and lowered and stopped at the depth which gives a maximal reading In this way the correct direction in which to proceed is accurately ascertained All metallic *instruments* are laid aside while the search proceeds Wooden tongue depressors or plastics can be used for temporary retractors

The probe handle has a control by which the operator can at will make most of the necessary adjustments without requiring an assistant at the instrument panel A pilot light shows when the instrument is in use

A Robbe[9] describes *high frequency metal localizer for removal of projectiles* The principle is detection of changes in self inductance which the metallic foreign body produces in a high frequency magnetic field It is to be noted that changes in self inductance are produced by nonmagnetic metals

APPARATUS—The magnetic field is produced by a coil built into a probe The coil with a condenser constitutes the reso

(9) Deut Militärarzt 7 1 15 January 194

ception, the starting point of true gas gangrene Joints as such are rarely, and only secondarily, affected

One of the earliest general symptoms is a mental change, manifested by loss of interest in environment or by euphoric optimism Pallor and slight conjunctival jaundice may be seen High temperature and relatively increased pulse rate are early but not constant signs Significant are odor of the wound and lifelessness and unnatural color of its margins, base and layers, appearance of slightly raised patches, light yellow or brown, on the periphery completes the picture Crepitation occurs later In 61 of 89 cases at this stage anemia and leukopenia were observed, and there was increased sedimentation rate

As roentgen rays reveal proteolysis and gas formation before clinical signs appear, early and repeated roentgen examination should be made of all suspicious areas

Melnikoff's observations on the frequency of kidney damage were not confirmed Resistance of kidneys was remarkable, as was also the rarity of bone infections, despite comminutions and sequestrations

Treatment followed strictly planned lines Confinement to bed for one to two months was obligatory, irrespective of localization of damage Ample feeding and cardiac stimulants were emphasized in the first six to ten days, with large supplies of vitamin C Streptocid up to 8 Gm was administered daily by mouth or intravenously three times daily in doses of 40 50 cc of an 0 8 per cent solution Blood transfusion of 400 to 1,000 cc amply justified itself

[Streptocid is a British trade name for sulfanilamide —Ed]

Enlargement and incisions of wounds were dominant in surgical treatment Dissection, carried out in 101 cases, should be limited to affected regions, with avoidance of healthy tissue and must produce maximal opening and drainage Amputation when joints were in

the skin, position can be determined before incision is made When deep seated, it is advisable to proceed surgically until in the immediate vicinity of the foreign body before using the probe

In Robbe's clinic 80 foreign bodies have been removed without risk to patient or surgeon A number of small metal fragments the size of half a pinhead have been safely localized in joints

This localizer is superior to all other methods for foreign bodies in chest and upper abdominal cavity, where respiratory movements are constantly affecting position of the missile

Gas Gangrene—Investigations on guinea pigs by L Tchernaia[1] showed that *immunization by serum* is possible *against gas gangrene*, the immunity being chiefly due to the antitoxic effect A concentration of 1 to 2 units per cc protects completely Therefore minimal prophylactic doses of the specific antitoxin for human beings should be 10 000 15,000 units

J B Ryline[2] reviews 171 cases of *gas gangrene* collected during the Finnish campaign

While blind wounds are especially favorable for spread of anaerobic infection, through and through wounds may also harbor it Careful primary excision of gunshot wounds is the best prophylaxis but does not always avert infection 42 per cent had had primary excision Climate, i e deep clean snow and severe winter does not prevent infection

Symptoms most frequently appear in two to four days, delayed infections are apt to be extremely severe In one case gas gangrene developed in the thigh muscles 1½ month after a comminuted fracture of the leg infection spreading from minute embedded shell fragments No part of the body is immune but parts with a rich blood supply (head, chest and neck) are relatively less often involved Muscle is without ex

(1) Khirurgiya 8 23 77 1940
(2) Ibid. 9 31 40 1940

Three patients were surveyed to the mainland One had free air beneath the diaphragm, was regarded as critically ill, but responded well to symptomatic treatment, another developed a tender mass in the left side of the abdomen and, although it disappeared after an enema and he was otherwise normal he continued to complain of sporadic abdominal pain, the third had fractures of the body of one and of the transverse processes of four lumbar vertebrae

The other two patients were operated on One had a roentgen diagnosis of intestinal obstruction which cleared up fairly promptly Four weeks after injury he had severe pain in the epigastrium and left hypochondrium, vomited once and lapsed into marked shock He did not respond to stimulative and supportive measures Operation disclosed gangrene of the first 40 cm of the jejunum due to volvulus caused by an adhesion to the posterior parietal peritoneum which sealed off a relatively recent perforation in the jejunum The gangrenous segment was resected Ultimate complete recovery is expected The other patient had a tender mass in the right upper abdominal quadrant in the region of the gallbladder This mass believed to represent an abscess, contained 500 cc foul smelling fluid and a piece of necrotic tissue which was found to be the greater omentum The wound was closed lightly around several ample drains communicating with the abscess cavity, and a colonic fistula became established A week later, a gangrenous segment of small bowel 8×3×2 cm was delivered from the wound but roentgen examination revealed no interruption of continuity of the small bowel The patient seems well on the road to recovery

Russell Gates[4] (M C U S N R) describes *roentgen findings* in chests of all and abdomens of 12 of the 35 patients Although all had symptoms referable mainly to the abdomen 30 showed abnormal densities in one or both lungs

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(4) U S Nav M Bull 41 1–19 January 1943

jured, was carried out in 45 cases The remaining 25 patients with joint injuries were treated conservatively or by extra articular dissection with arthrotomy Immobilization in plaster is second in importance only to surgical measures It should interfere as little as possible with circulation, and the plaster extend over a wide area

Wounds were dressed with 2 per cent chloramine or irrigated with 1 per cent chloramine by the Carrel Dakin method, especially dirty wounds with heavy contusion This irrigation with fixation, produced excellent results in 45 of 47 very ill men Later when granulations had appeared fish grease, rivanol or calcium chloride was used for dressings which were rarely changed

Ryvline is not impressed with specific antiserum but thinks irrigation and other measures may lead to greater production of immune substances in the patient

Only nine men lost their limbs through amputations, *if those are excluded in whom absolute indications for* immediate amputation were present on admission Total fatality rate was 7 6 per cent exclusion of seven patients moribund on admission reduces this to 4 6 per cent

Immersion Blast Injuries — H L Pugh[3] (M C U S N) reports that surgical consultation was requested for 7 of 35 patients recently observed Two died the day of admission having survived their injury 5 and 12 days respectively The first had free air beneath the diaphragm and autopsy revealed multiple perforations of the lower ileum and jejunum with general peritonitis of several days' standing The perforations appeared to have developed at the site of local devitalized areas Both lungs showed contusion Autopsy in the second revealed massive hemorrhage into the peritoneal cavity, the entire cecum and ascending colon being a formless, functionless hemorrhagic mass The lungs showed severe contusion There was no demonstrable evidence of perforation in this man's alimentary canal

(3) U S Nav M Bull 41 9 1 January 1943

charge was overwhelming, perforations were frequently discovered The effect of the charges apparently could be minimized when the animal was placed on its back

Perforations of the intestinal tract occur over areas which contain fecal material in scybalous form and probably over air bubbles, with resultant peritonitis This would explain perforations in clinically observed immersion blast injury occurring in the colon terminal ileum and first portion of the jejunum The perforations are an immediate result of the blast and do not occur later because of necrosis of the bowel wall Therefore, these perforations demand early surgical intervention, hemorrhagic lesions do not require surgical treatment

Protection to the chest was apparently afforded men exposed to immersion blast injury by the heavy rigid life jacket, as a rigid covering was shown to protect the thorax of animals exposed to immersion blast Probably extension of the life jacket to cover the abdomen would be beneficial Swimming on the back affords some protection to both chest and abdomen Theories as to causation of immersion blast and air blast injuries are still controversial There was no evidence in the experiments that water was forced through the anus with rupture of the bowel The lesions seemed to be a direct effect of the explosive force itself transmitted through the elastic walls of the abdomen and thorax

P B Ascroft[4] reports a *fatal case of blast injury of the lungs associated with a curious lesion of the cerebrum* due to explosion of a hand grenade at short range The multiple external injuries were not in themselves fatal The extensive hemorrhagic infiltration of the lungs was typical of the kind due to blast An unexpected finding at autopsy was a peculiar discoloration of large areas of the cerebral hemispheres due to many minute hemorrhages confined to the gray matter of the cortex There was no factor other than the effect of the explosion to account for the changes in the cortex

(4) J Roy Army M C 80 142 146 March 1943

There was some gaseous distention of the small intestine in all There was evidence of perforation of the intestinal tract in four, two showing free gas in peritoneal cavity and two, small bubbles of gas apparently in tissues outside the intestinal tract Rather large, soft tissue densities, presumably due to accumulations of fluid, were seen in four cases Barium meal in five recovered patients showed definite abnormality in mucosal pattern and walls of the small intestine in one and a fecal fistula at the hepatic flexure in one

In *experimental immersion blast injury* of guinea pigs Morris T Friedell and Archibald M Ecklund[3] (M C, U S N R) found two types of abdominal lesions a hemorrhagic condition of the muscularis portion of the bowel wall and perforations and larger tears in the bowel wall

The chest lesions were constant, symmetrical areas of hemorrhage on the surfaces of the lung which were nearest to the explosive source Thus the dependent edges of the middle lobes on both sides were usually involved, and the posterior surface was involved when the back was turned toward the blast source Thoracic lesions varied in severity according to distance of explosion, size of the charge and amount of protection afforded the thorax The thoracic involvement accounted for death in most of the animals Abdominal lesions were not produced except when the lungs were so severely damaged that death ensued This death occurred a few minutes after the explosion and the following conditions were noted in all the animal was fairly lively for two to three minutes, air hunger then ensued and minor convulsions followed death came 5 10 minutes after the blast A chamber was devised to protect the lungs so that previously fatal explosive conditions were no longer lethal The abdominal lesions were present, however and as the force of the charge grew greater the hemorrhagic lesions gave way to perforations When the force of the

(3) U S Nav M Bull 41 353 363 March 1943

can be used to control infection and reduce a granulating area to a regular firm condition (4) Dressings are painless and atraumatic Use of tulle gras prevents surface damage There is opportunity for airing and cleaning of beds The odor of infected tan is eliminated Patients rapidly accommodate to the regime and favor it (5) Third degree burns are ready in the shortest possible time for skin grafting

The two main disadvantages are the extra work and risk of cross infection The saline method has been most satisfactory for burns of the extremities in which moderate grades of burn shock are well controlled by plasma transfusion It is still on trial for severe and extensive body burns

First Aid Treatment —(1) Any burn of first or second degree which does not involve hands face or genitals may be regarded as minor Morphine may be indicated for pain The area should be cleaned with soap and water and a dressing of vaseline soft paraffin or preferably a noncoagulant water soluble jelly applied (2) A more severe or extensive burn or one which involves the special regions mentioned is a major burn Treatment of general condition and early evacuation are prime considerations Full doses of morphine are given Clothes are disturbed as little as possible warm blankets are applied hot drinks are given Severe burn shock is not usually manifest for five or six hours and is likely to be serious if over 25 per cent of the body surface is involved A sterile towel, sterile lint or dry or vaseline gauze over the exposed parts is indicated If hospital treatment or transport is not available in four hours plasma or serum should be used Under adverse conditions coagulation of an extensive burn may be necessary For this purpose, the vital dyes are not vicious and their coagulum is more easily removed

Treatment when Coagulation Is Necessary —Coagulation must be carried out under surgical conditions Face, hands and flexure line should not be included After debridement they should be dressed with saline solution over a nonadherent dressing For transport vaseline gauze bandages can be used Tan should be removed at the earliest opportunity after its necessary function is complete

Treatment without Tanning —When tanning is contraindicated or not necessary as a life saving measure, wet saline solution dressings can be used and vaseline gauze bandages

Burns—B K Rank[5] condemns indiscriminate tanning of *burns* because end results in terms of worthwhile function are often disappointing and sometimes beyond reconstruction Functional prognosis of any burn depends on the region involved and healing time The earlier a burn is treated the better the function, immobilization will be shorter, there will be less fibrosis from replacement of accumulative granulation tissue and less fibrotic reaction to surface sepsis Early coagulation of a cleansed burn undoubtedly precludes widespread secondary infection, but if time has passed or the burn cannot be adequately cleaned coagulation may create nondrained sepsis under tension, with a large area for septic absorption From the aspect of function, tanning of any third degree burn is contraindicated If it is necessary, as an initial life saver, it must be removed as soon as its life saving function is accomplished

For third degree burns Blair and Barrett Brown advocated saline baths There are various advantages of saline regime (1) Early function is permitted, unembarrassed by dressings (2) It does not further traumatize the burned area The heterogeneous nature of most burns is borne out by rapid spontaneous epithelization often noted in burns wrongly assessed as third degree This contrasts notably with findings after a tan has separated where skin covered and raw areas are clearly defined Many of these raw areas would show spontaneous proliferation had they not been tanned (3) Infection is controlled Without addition of antiseptics dead tissue rapidly separates burned areas soon become clean The method is compatible with correct use of sulfanilamide so that any streptococcic infection can be eliminated For sulfanilamide to be effective locally, the surface must be cleared of slough and debris, moisture is required, and the drug must be effectively distributed Later, hypertonic saline solution

(5) Australian & New Zealand J Surg 1 103 110 October 194?

top of the bottle 3, inlet through which air flows when blood is being given, 4, self sealing latex rubber disk, which has a nipple on its under surface which fits into and seals the air inlet (3), 5, metal disk with a nipple on its under surface which passes through a hole in the rubber disk (4) and fits into a recess in the top of the bung, 6, metal collar which screws onto the neck of the bottle and presses all the components together, thus sealing the flask A metal cap with a thin rubber washer between it and the metal disk screws onto the metal collar, thus keeping the top of the metal plate and exposed parts of the rubber disk sterile

TECHNIC—Giving sets, taking sets, blood filters and instruments are wrapped separately in lint or Gamgee tissue, placed

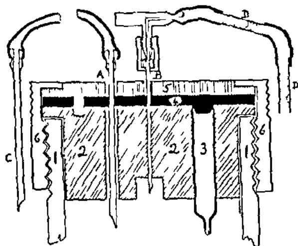


Fig 27 —Solu ac bung assembled for collection of blood

in unbleached calico wrappers and sterilized by autoclaving for 30 minutes at 15 lb pressure, followed by vacuum for 20 minutes

Before sterilization of the bottles, 350 cc isotonic (5 4 per cent) glucose solution is placed in each bottle The components of the bungs, with the exception of the metal caps, are assembled, but the metal collars are screwed on just enough to engage the threads on the necks of the bottles The bottles together with the caps are placed in the autoclave and, with the door loosely closed heated for 10 minutes to drive off most of the contained air Then the autoclave door is firmly closed and the bottles are sterilized for 30 minutes at 15 lb pressure The main steam supply is turned off, the chamber valve being left open If the autoclave is primus heated the

applied as an evacuation dressing As the functional result of a burn must often be jeopardized by coagulation treatment, these cases must have priority for air evacuation to a base hospital where there is a saline bath

SKIN GRAFTING —Split skin grafts should be used when possible The whole area is covered, nothing is left to secondary intention healing Induration wrinkling and contraction of grafted areas are minimized by early use before thick accumulation of granulation tissue For wounds granulating a long time, this excess granulation is removed with a blunt instrument For the chronic unhealed burned area with deep fibrosis excision of wound and fibrotic area should be carried out before grafting The final texture is always improved by massage with lanolin

Results of grafting are uniformly good only if the areas are adequately prepared Correct use of local sulfanilamide when indicated has been a major factor in making free grafting on granulating wounds a sound surgical procedure The sulfanilamide and saline sequence or eusol and saline solution (when sulfanilamide is not indicated) and a period of firm pressure on the areas to be grafted are essential Pinch grafts are second choice Vascular skin and fat flaps are indicated early when tendons or joints are exposed, but whenever possible an open wound should be healed by a free graft before they are used

R Officer[6] (M C , R A A) discusses the changes which occur in blood during storage and render it dangerous to administer He also describes a technic for collection, transport and *storage of blood on active service*

APPARATUS —The apparatus required for collection is contained in the standard Australian Army transfusion pannier The soluvac bottles were designed for all intravenous operations The contained sterile fluid, e g , normal saline solution, 5 per cent glucose in normal saline solution, may be administered as required and the empty bottle used for immediate administration of a transfusion or for storage of blood To make it possible to carry out these different procedures safely, the method of sealing the bottle is necessarily rather complex, but its assembly can be mastered easily by nursing orderlies after little study

Figure 27 shows the soluvac bung assembly in section The parts are *1*, neck of the bottle onto which a metal collar(*6*) is screwed, *2*, rubber bung, with a shoulder which fits onto the

(6) Austral an & New Zeala d J Surg 12 111 118 Octob r 194?

1,100 cc., which almost fills it The perforator is removed, the metal cap replaced on the bottle and the bottle placed in cold storage

The blood remaining in the tubing after removal of the needles should be run into a small test tube containing citrate solution This test tube is attached to the bottle, and its contents are used for cross matching if required The bottle should be labeled with the donor s group, the date of collection and the amount of blood collected Blood should be stored at between 2 and 6 C

To eliminate disadvantages of wooden litter hoists, H C Weber[7] (M C, U S N) designed the *multiple stretcher* (Figs 30 32)

Apparatus—This is made in two sections, each consisting of two steel or duralumin pipe frames, and hinged together at the foot end Individual patients are strapped to canvas

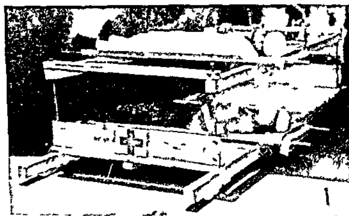


Fig 28—Old Army litter hoist

sheets which then are securely laced to the frames Weight of patient is suspended with a harness running from crotch to shoulders and padded in the crotch There is an extra strap, 1½ in wide across the chest Legs are held in place by four transverse tie ties, 20 in long, two above the knees and two across the shins Two T type hinges welded to foot end of frames permit automatic opening of stretcher when tension on the 10 or 8 ft carrying sling is released by stretcher touching deck Four carrying arms secured to movable sleeves and placed at proper distance from the top prevent the

(7) U S Nav M B ll [illegible] January 1943

heater is merely turned off Neither vacuum nor dry heat is to be used The whole autoclave and its content are left to cool so that the chamber pressure becomes reduced at a rate corresponding to the fall in temperature, evaporation of the glucose solution thus being avoided When the chamber pressure reaches zero (i e atmospheric pressure) the door is opened each bottle is removed separately and placed on a table and the collar is screwed down tightly rotation of the metal disk is prevented by firm pressure on it with a sterile swab The metal cap is screwed into place The bottles are thus completely sealed and when cool will contain a strong vacuum Occasionally the glucose solution in one or two bottles at the back of the autoclave will have partly evaporated these should be 'topped up' and resterilized

Donors should have good veins because the blood has to be collected rapidly They should have only a light nonfatty meal beforehand so that their blood will contain a minimum of free fat The arm band of a sphygmomanometer is placed on the donor's arm and the pressure raised to 70 mm A suitable vein is selected local anesthetic injected and a small puncture made in the skin at the proposed site of puncture Pressure in the armband is then released

An ampule of 4 per cent sodium citrate is opened and the donor needle (Fig 27 *C*) of a taking set is inserted until well below the fluid After removal of the cap from a solu-vac bottle, the bottle needle is pushed through the rubber disk as shown in Figure 27 *A* Immediately the vacuum sucks citrate solution into the bottle but care must be taken that no air is sucked in as well As soon as 70 cc of the solution has entered the bottle the rubber tubing is pinched to stop the flow The rubber tubing is so held until the whole of the vacuum has been dispersed which is brought about by inserting the bung perforator as shown in Figure 27, *B* Air can be heard flowing into the bottle through the two air filters attached to the perforator (Fig 27, *D*) indicating that the perforator is placed correctly If no vacuum is found in the bottle, it must be discarded When the air has ceased to pass through the air filters the rubber tubing may be released and a Higginson's bulb is attached to the end of the air filter The pressure in the armband is again raised to 70 mm and the donor needle inserted into the selected vein Throughout collection the flask is gently rotated for the purpose of insuring thorough mixing, and continuous suction is applied by means of the Higginson's bulb

When the required volume of blood 700 cc (approximately 24 oz), is collected the tourniquet is released and the bottle needle removed The total volume in the bottle is now about

make a spreader unnecessary To expedite attaching sling to stretcher, snap hooks are secured to the four ends of the sling

To carry 20 or more severely wounded men from beach to ship, 16 patients can be placed on the bottom of the motor launch and 4 strapped in position on the stretcher, ready to be hoisted on board While stretcher bearers take them from the multiple stretcher and place them out of the way on deck, the multiple stretcher can hoist the next four and continue thus until the load is taken on board While the patients are secured in the multiple stretcher in the launch, the stretcher is in an athwartships position and does not project beyond the sides

This compact, safe stretcher has many advantages More stretcher cases can be carried on one trip of the motor launch with additional room for ambulatory cases Army litters can be left ashore to collect more wounded on the beach while the launch makes a trip to the ship With every operation of the crane four men are hoisted on board instead of one. They also permit conversion of station wagons and delivery trucks into ambulances by providing proper brackets for the two sections and pulling out the hinge rod They may be used as emergency operating or dressing tables if placed on suitable supports or as stretchers for ambulance planes The frame without canvas, if made in proper dimensions, can be used to hoist patients in four Stokes stretchers by placing a Stokes stretcher in each compartment

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WOUND HEALING AND PATHOLOGIC COMPLICATIONS

Surgery in the Aged.—Frederick W Bancroft[8] (New York City) considers persons from 65 years onward as the aged but recognizes that some patients of 50 are much older in their arteries, outlook on life and minds than others over 70 The following indications for surgery in this age group will be accepted by most surgeons relief of pain, relief of infection if the operative procedure is not too hazardous, mobilization of a patient out of bed, because the dangers of being bed ridden are greater than the operative risk as in internal fixation of fractures of the neck of the femur, excision

(8) New York State J Med 43 37 40 Jan. 1 1943

stretcher s closing to less than 125 degrees when loaded These arms slide up ½ in and lock automatically against a cut-out stop collar when stretcher is hoisted Four other stop collars with eye bolts below allow sleeves to move down 1½ in and

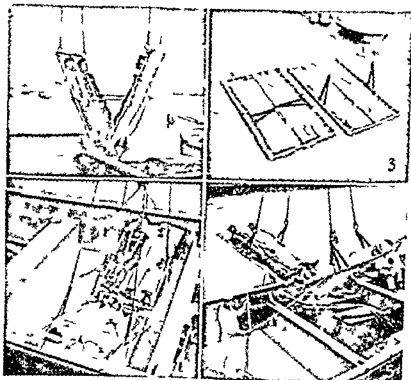


Fig 29 (top left) —First design discarded note uncomfortable position of patients and drag on crotch
Fig 30 (top right) —Second design dismantled note position of carrying arms Four harnesses do not show because of lack of contrast Hinge rod on right canvas
Fig 31 (bottom left) —Ends of stretcher resting on gunwales sling slightly under tension
Fig 32 (bottom right) —New design in operation note absence of spreaders and the angle and guy line

fold medially for closing compactly after use The two ends of a 16 or 20 ft line fasten to the eyes, serving as a double guy line which is used like the reins of a harness The sections are kept apart at 125 degrees calculation being based on center of gravity and parallelogram of forces Even a strong pull on the guy lines does not upset equilibrium The sling is the same length as the double guy line The carrying arms

vantage Elderly patients must be kept moving to avoid hypostatic pneumonia and should be out of bed at the earliest possible moment Feeding should be done as soon after operation as possible Venous stasis is one of the main factors in producing thrombosis and embolism Therefore, efforts should be directed toward active motion of the legs, often against resistance, copious use of fluids and prevention of distention If a patient has an unexplained low rise of temperature postoperatively for more than four or five days, Bancroft administers sodium thiosulfate as a prophylaxis against thrombosis

Wound Healing—Investigations by J K Berman Alan D Houser and William A Kurtz[5] (Indiana Univ) *on wound immunity in guinea pigs show that healing* wounds are more susceptible to contamination by Staphylococcus aureus during the first 24 hours than are fresh wounds Immunity in a healing incision which is not traumatized occurs four days after surgery When sutures are removed from a healing wound, immunity does not occur until the fifth day after operation If the wound is reopened, this immunity does not occur until the sixth day, probably owing to the trauma incurred in reopening The anatomic extent of wound immunity seems to be limited to the area surrounded by granulation tissue The entire abdominal wall around a previous incision is less susceptible to staphylococcus implantation after the fourth postoperative day

Effect of Heparin on Wound Healing—Harold Laufman and Richard E Heller[6] (Northwestern Univ) found that the drug had no appreciable effect on the healing process of surgically produced abdominal wounds in dogs whose blood protein and blood vitamin C levels were within normal limits The only deleterious action was pooling of blood in the wound This accumulation of blood in presence of heparinization was apparently due either to inadequate hemostasis at operation or

(5) Surg Gynec & Obst 77 05 208 August 1943
(6) Ibid 76 655 658 June 1943

of cancer, relief of gangrene in peripheral vascular diseases, relief of chronic obstructive diseases, as the hypertrophied prostate, pyloric obstruction, etc While these are general principles that may be followed, there are exceptions to most of them

Preoperative knowledge of the patient's blood chemistry is much more important than in the more active years of life An estimate of the patient's cardiac reserve and ability to take an anesthetic and a careful study of the type of anesthesia for the patient's age and surgical condition are important The genito urinary system should be carefully analyzed The plasma protein is often surprisingly low and should be corrected Study of the vitamin intake is indicated

The problem of anesthesia probably requires more surgical judgment than the operation In abdominal conditions, use of novocain local and block anesthesia, supplemented by gas or intravenous anesthesia, is probably the safest procedure Cyclopropane often supplemented by a minimal dose of avertin, will in many cases prove the anesthetic of choice

Crymotherapy to an extremity is a useful adjunct in peripheral vascular diseases Gentleness in handling tissues is most important Sulfonamides are of great aid in treatment of infections but the aged are more apt to develop late deficiency diseases through prolonged use of sulfonamides and therefore they should be discontinued as soon as possible

If an operation is to last for any length of time, it is advisable to administer blood plasma or glucose intravenously to prevent insidious onset of shock Intravenous solutions must be given slowly in order not to embarrass the right side of the heart Adrenal cortex extract before and after operation is often advisable Operative procedures should be based on the minimal surgery that will give the patient relief

Postoperative hyperventilation of the lungs with oxygen and carbon dioxide is often of considerable ad

acid solution during the first four days only, during the first eight days only and during the whole period of healing except the first four days, still shows substantial gains, but inferior to those observed when the wounds are continuously (one dressing per day) treated with the solution during the whole period of cicatrization

John Winslow Hirshfeld, Matthew A Pilling and Mark E Maun[8] (Wayne Univ) *compared the effects of tanning agents and of vaseline gauze on fresh wounds of man* by applying them to donor sites of skin grafts Patients complained that the stiff eschars on sites treated with tannic acid caused considerable pain, while comparable sites treated with vaseline gauze were relatively painless Sites treated by vaseline gauze healed more quickly than those treated by tannic acid Biopsy specimens showed that, to form the eschar, the tanning agents destroyed the dermis to a great depth In addition, a marked leukocytic exudate was found beneath the eschar, with further destruction of the collagenous bundles of the dermis The portions of the epithelial structures contained in these layers were destroyed, so that epithelization finally took place beneath the exudate Vaseline gauze proved to be nonirritating to the exposed dermis, hence only a mild red blood corpuscle and leukocytic exudate was found The only visible damage to the dermis was in cases showing some infection Re epithelization from the uninjured dermal glands was more prompt than in the donor sites treated by tanning agents

[Tannic acid seems to be definitely on the way out —Ed]

The reaction of the blood lymphocytes to trauma and healing was investigated by Alan H Cruickshank[9] (Univ of Aberdeen) After severe operations on animals, such as removal of the whole or part of the alimentary canal, decerebration and wounds of the skin, the blood lymphocytes fell within a few hours Lymphocyte counts

(8) Surg Gyn c & Obst 76 556 561 May 1943
(9) Lancet 2 304 306 Sept 12 1942

to resumption of bleeding in the wound after apparently adequate hemostasis at operation Heparin appeared to delay healing slightly up to the fourth postoperative day but had no real effect after that It is emphasized that when it is necessary to administer heparin after operation, the most meticulous hemostatic precautions should be taken at operation Whenever possible nonabsorbable or slowly absorbable suture material should be used

Louis Paul Dugal and Henri Laugier[7] (Univ of Montreal) used rabbits to test the hypothesis that calcium precipitating agents oxalic acid, sodium oxalate, potassium oxalate and sodium fluoride, probably accelerate *wound healing* Preliminary experiments showed that sodium fluoride retards healing and that wounds treated with the other substances heal much faster than those treated with chloramine T All reported results were obtained from comparisons of two approximately equal wounds of the back of the same animal, one wound being treated with the test solution and the other with 8 per 1,000 salt solution This eliminated differences in healing time due to individual factors

The effects of different concentrations of the agents used led to the conclusion that the most favorable solutions are the least concentrated (about 0 01 N) The effects of 2 per 1 000 oxalic acid solution were studied in detail 19 of 23 experiments proved that wounds treated with this concentration in 8 per 1 000 salt solution heal much faster than control wounds treated with the salt solution only This salt solution was adopted after a series of experiments in which different concentrations were tested for their effect on wound healing the 8 per 1 000 concentration was as good as any other and better than most Time of healing when treated with oxalic acid was reduced by 42 per cent at most and 22 per cent as average

Treatment of experimental wounds with the oxalic

(7) Rev canad de biol 1 687 719 December 194

i then applied and a further irrigation with the same solution is carried out at once to sterilize the interior of the envelop Sub equently, the wound is irrigated with a 1 20 I S H solu tion three times a day The irrigation fluid should always be at a temperature of 100 F , and its cleansing effect is increased by lowering its surface tension with a solution of sodium or ammonium lauryl sulfate, 1 drachm to 1 pt hypochlorite It

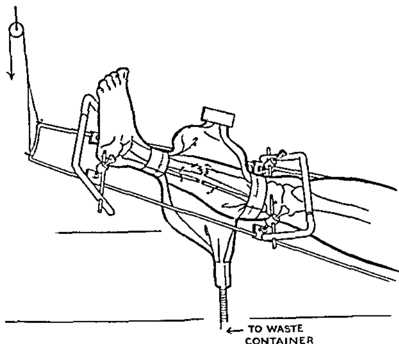


Fig 3 —Compound fracture of tibia and fibula showing occlusive env lop applied to wound and fixation of fracture by Steinmann s pins clamps and a Thomas splint

is advisable to use this detergent solution for the initial cleans ing of the wound only and perhaps occasionally afterward if the bag becomes difficult to clean because repeated and pro longed use of lauryl sulfate causes some irritation of the super ficial layers of the wound and skin After each irrigation the envelop must be thoroughly drained It must not be used as a wound bath and should be dried on each occasion by a current of warm filtered air and the openings sealed Excessive inflation must be avoided because of likely damage to the envelop and production of leakage If it is necessary to control hemorrhage by pressure this should be applied outside the envelop

were done before and 24 hours after various operations in 27 human subjects 22 showed a fall in blood lymphocytes after operation In rabbits and rats there was a blood lymphocytosis during healing of wounds of the skin These findings seem to support the view that lymphocytes may undergo transformation into other types of cell, for example into fibroblasts

John J Moorhead and Lester J Unger[1] (New York City), for infected wounds, tried as *surgical dressing, human red cell concentrate* resulting from processing of blood plasma Response was prompt and satisfactory The striking features were subsidence of purulent secretion, smooth healthy granulation, impervious veneer coverage preventing fluid loss and reinfection, painless application and conversion of a waste product into a useful agency Burns infected and noninfected wounds and certain types of ulceration have been benefited in the authors' limited experience

TECHNIC —The red blood cell concentrate was prepared from blood of healthy donors withdrawn under sterile precautions by a closed system in 5 per cent sodium citrate, centrifuged at 2 000 revolutions per minute for 45 minutes and allowed to stand in a refrigerator at 3 to 5 C After seven days the supernatant plasma was removed by a closed system The cells of four individuals without regard to blood group were pooled and returned to the refrigerator

Ten to 20 days elapsed from the time of drawing until the material was used It was quite viscid and had the consistency of thin red paint Bacteriologic examination showed it to be sterile

Use of Irrigation Envelops in Treatment of Lacerated Wounds and Compound Fractures is recommended by G K McKee[9]

TECHNIC —The wound is cleansed under a jet of a 1 5 dilution of 1 per cent electrolytic sodium hypochlorite (F S H), directed onto the wound and its surroundings while a thorough toilet of the wound is carried out Patience and care are essential at this stage An occlusive envelop (Fig 33)

(1) Am J Surg 9 104 105 January 1943
(9) Brit J Surg 30 3 8 335 April, 1943

MOST EFFICIENT OF 100 DETERGENTS AND DETERGENT MIXTURES TESTED*

COMMERCIAL NAME	PROPORTIONS USED	CHEMICAL NATURE	ACTION	PHYSICAL NATURE OF MIXTURE
Sulfatate Atlas—G 772 S (Atlas Powder Co)	9 parts 1 part	Sulfonated petroleum Sorbitan laurate	Penetrant and detergent Emulsifier	Clear orange yellow oil Soluble in 3% NaCl
Sulfatate (Glyco Products Co)	11 parts	Sulfonated petroleum	Penetrant and detergent	Clear orange-yellow oil Soluble in 3% NaCl
Aerosol OT 25% aq (Am Cyanamid Co)	1 part	Di octyl sodium sulfo succinate	Detergent	
Sulfatate *Orvus* (*Procter* & Gamble Co)	19 parts 1 part	Sulfonated petroleum A fatty alcohol sulfate	Penetrant and detergent Detergent	Clear orange-yellow oil Soluble in 3% NaCl
Sulfatate Tergitol 4 (Carbon & Carbide Co)	49 parts 1 part	Sulfonated petroleum Higher secondary alkyl sodium sulfonate	Penetrant and detergent Detergent	Clear yellow oil Soluble in 3% NaCl
Sulfatate Oil Turkey Red (Eimer & Amend)	6 parts 5 parts	Sulfonated petroleum Sulfonated castor oil	Penetrant and detergent Penetrant and detergent	Clear orange-yellow oil Soluble in 3% NaCl
Aerosol OT 25% aq	1 part	Di octyl sodium sulfo succinate	Detergent	
Oil Turkey Red Aerosol OT 25% aq	11 parts 1 part	Sulfonated petroleum Di octyl sodium sulfo succinate	Penetrant and detergent Detergent	Thick orange-yellow oil Soluble in 3% NaCl

In all tests made on normal intact skin no 6 fuel oil and al o a heavy grease (Permatex Water Pump Lubricant S W Permatex Co Sheepshead Bay N Y) were the final test substances

This technic was used in 32 cases, including lacerations, bullet wounds and compound fractures It is a simple method of dealing with wounds, and the cleansing of dirty wounds is effective so that healing or preparation for skin grafting is rapid Sepsis can be controlled so that active movements can be instituted immediately It is an excellent method for dealing with compound fractures, provided that a suitable way of dealing with the fracture can be used The plaster cast is unsuitable, and open plating may be difficult because of the electrochemical reaction around the plate as a result of the use of an electrolyte solution The use of Steinmann's pins, transfixing the fragments and then clamping the pins to the side bars of a Thomas splint, is suitable for fractures of the tibia and fibula and of the femur

Most patients had severe injuries, one with multiple bullet wounds dying of gas gangrene, but they were on the whole remarkable because of freedom from pain and absence of general and local reaction

Norman Rosenberg[1] (New York City) discusses *use of detergents in cleansing and local treatment of burns* Vigorous cleansing methods have no place in preliminary treatment of burns because anesthesia is required shock is increased and injury to remaining healthy tissue results from scrubbing and use of irritating cleansing agents Certain of the synthetic detergents used in one of several combinations act as cleansing agents in local treatment of burns Properties which make them superior to other cleansing agents are (1) their ability to penetrate and "solubilize" substances such as greases, oils and fats, as well as particulate matter, these types of contaminants are thus rendered more easily removable by water, (2) their lack of irritating or noticeable tissue damaging properties as used (3) their antiseptic nature, and (4) the fact that, after all grease is removed subsequent "take" of dye or tanning agent is made easier and a proper eschar is more readily formed

(1) Surgery 13 385 393 March 1943

carcinoma Both had been on a deficient diet for a long time In the first six plastic operations, performed during the five months following the original intervention, failed Scurvy developed and after administration of vitamin C in the form of orange juice by mouth and ascorbic acid by vein the wound healed Thus, failure of wound healing preceded development of typical scurvy In a case reported by Crandon and Lund, petechiae and papules appeared before there was any impairment in wound healing Keratosis pilaris developed despite adequate intake of vitamin A and would seem to be dependent on vitamin C deficiency

In the second patient phlebitis developed but not scurvy Adequate vitamin C therapy did not help, and eight plastic operations, including one skin graft, failed The plasma ascorbic acid value was normal, which would seem to explain failure of vitamin C therapy to aid in wound healing However local factors may have impaired the healing process The patient received 54 roentgen treatments to the neck, which may have impaired the local histiogenic potentialities of the tissues to such an extent that repair was retarded Nutritional conditions were adequate to bring about wound healing in the thigh from which the skin graft was taken At this site no local factors interfered with prompt healing

While the therapeutic response points to vitamin C deficiency in the failure of the first wound to heal, the possible deficiency of other nutrients must not be overlooked Both patients were probably deficient in the various factors of the B complex, in vitamin A and possibly also in vitamin K Patients such as these should receive a diet rich in all vitamins and minerals and high in protein

Infections —Frank L Meleney[4] (Presbyterian Hosp, New York City), as Chairman of the Subcommittee on Surgical Infections of the National Research Council,

(4) Ann. Surg 118 171 186 August 1943

The principle of using a penetrant detergent such as sulfonated petroleum *as a carrier for other more power* ful detergents is especially valuable as it greatly diminishes the amount of mechanical dispersion required to distribute the cleansing solution uniformly through out an oil or grease layer (see Table)

In clinical tests *with a number of detergent mixtures* performed both on controls with normal, intact skin and on 25 patients with relatively mild second degree burns the properties listed were substantiated More than three quarters of the burns when first observed in the emer gency service *of a metropolitan hospital* were covered with grease oil fats or ointments It is in this group especially that the action of the synthetic detergents is best demonstrated Burns covered with grease and oil the result of military engagements on sea and land, rep resent a problem in which application of these new cleansing agents may be of specific benefit

Henry N Harkins[2] (Henry Ford Hosp) presents a *new method of making a relaxing incision which com* bines the advantages of primary closure by a skin graft with the lack of necessity for making a separate wound to obtain closure The *dermatome flap relaxing incision* consists in making a dermatome flap which is left attached at one end and reflected back The relax ing incision is then made in the donor area and the flap turned down again to cover the raw area made by the incision

This method is applicable to all situations requiring relaxing incisions which are of special advantage for wounds of the extremities in which large superficial tumors or scars are excised

Delayed wound healing has been noted for many years *in persons with scurvy or general malnutrition* *Edmund* L Housel and Louis H Clerf[3] (Philadelphia) report two cases in patients who *underwent laryngectomy for*

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(2) Am J Surg 59 79 8 Jan 1943
(3) Pennsylvania M J 46 1 3 Oct 194

shock, heavy gross contamination and severe tissue damage Operation after three hours, incomplete debridement and prolonged washing are associated with a high incidence of infection Partly closed wounds show a higher figure than those left open or completely closed Closure under tension seems frequently to play a major role in occurrence of infection Tendon repair cases show a high rate of infection, which has not been lowered by the sulfonamides By every method of grouping these cases from the viewpoint of chemotherapy, no evidence can be found that sulfanilamide or equal parts of sulfanilamide and sulfadiazine locally, or sulfadiazine generally with or without local use of drugs, has decreased incidence of local infection However, incidence of septicemia or death is extremely low, and spread of infection from the local site has been minimized

There were two deaths from infection In one case, no primary drug was used, in the other, primary drug was used locally and generally

Hemolytic streptococci, coagulase positive staphylococci, pathogenic gram negative bacilli, Welch's bacillus and anaerobic cocci stand out as most important These were found in the debrided tissues in many cases, but mostly did not persist, being removed by the operative procedures or local body defenses, or both However, organisms of these groups frequently appeared in later cultures in cases in which they were not originally found They probably often represented secondary contamination occurring during treatment There was no greater reduction of the original or secondary contamination in the drug treated patients than in the controls who received no drug

Incidence of infection in compound fractures is 21 7 per cent, serious infections being somewhat higher than trivial ones Shock maximal gross contamination and maximal tissue damage are associated with the most serious infections Early operation complete wound de

presents the results of a study of *prevention of infection in contaminated accidental wounds, compound fractures and burns*

Beginning on Feb 1, 1942, eight units in different medical centers began the study which was concerned chiefly with the question of the effectiveness of the sulfonamides in the prevention of infection in accidental wounds, compound fractures and burns in civilian patients simulating war casualties Sulfadiazine was selected as the drug of choice in systemic administration Equal parts of sulfanilamide and sulfadiazine powder were used for local application to the wounds

Seven units studied the three major categories of injuries (soft part injuries compound fractures and burns) while the eighth unit concentrated on burns There were strong advocates for three different methods of treatment of burns tannic acid, vaseline compression dressing and sulfadiazine in triethanolamine spray A fourth experimental method was permitted each unit

Surgeons were directed to perform as complete wound debridement as possible but were given liberty to decide other details of treatment In units in which non drug treated controls were used, control and treated patients alternated regularly Accurate observations were made and exact records kept All units have had similar experiences and remarkably similar results

Summary sheets were completed as soon as possible after wound healing Preliminary reports were sent in on all compound fractures within two months and changes were incorporated later if infection or delayed bone healing supervened The data were transferred to punch cards and then analyzed according to common factors The records from the first 1,500 cases (682 wounds of the soft parts 471 compound fractures and 347 burns) are summarized by Meleney

Incidence of infection in soft part wounds is 16 5 per cent, with twice as many trivial as serious infections Serious infections are associated significantly with

patients might have died without infection Both had local and general treatment with the sulfonamides

Many of the hemolytic streptococci persist in the burned area or come in as new contaminants in the face of local and general sulfonamide therapy The staphylococci are the most numerous of the pathogens in the persistent and new cultures but the gram negative aerobic bacilli, particularly the Escherichia coli Bacillus pyocyaneus and Bacillus proteus groups, run the staphylococci a close race If the problem of infection in burns is to be solved, it must be concerned with all these groups of organisms

The sulfonamides minimize the general spread of infections and cut down the incidence of septicemia and death No evidence was found that they lessen the incidence of local infection To decrease incidence of local infection in war wounds and burns, some other forms of the sulfonamides or some other bacteriostatic agents must be found which will be effective against the contaminating organisms in the presence of damaged tissue

[This study is the most carefully controlled one that has ever been made of the effects of the sulfonamides in preventing wound infections For that matter there has never been a comparable study on so large a scale of the bacteria present in infected wounds The conclusions therefore are very important that the sulfonamides do not lessen the incidence of local infection —Ed]

Charles Weiss[3] (San Francisco) has demonstrated that *Bacteroides melaninogenicus* a small gram negative, anaerobic nonsporulating, black pigment producing germ should be regarded as *a pathogen important in surgical infections* He has isolated it in combination with other aerobic and anaerobic bacteria from 45 surgical cases representing various infected wounds lesions of the pleura peritoneum gastro intestinal respiratory and genito urinary tracts Others have cultivated it from the blood stream during puerperal infection At autopsy he found it in the heart s blood peritoneum and visceral organs Experimentally Weiss has shown that it pos

(3) Surgery 13 683 691 May 1943

bridement and prolonged wound washing do not play as important roles as in soft part wounds When wounds are closed completely incidence of serious infection is less than when they are left open or partially closed General or combined local and general use of sulfonamides alone has not lowered the incidence of local infection Although only two patients died of infection (they yielded no positive blood cultures and had local and general prophylactic sulfonamide therapy), 5 required excision of dead tissue 11 opening of wounds 15 a new incision for drainage of abscesses and 16 secondary amputation

Hemolytic streptococci coagulase positive Staphylococcus aureus and Welch s bacillus were found in a higher proportion of these cases than in the soft part wounds furthermore the organisms more often persisted and appeared as new cultures The pathogenic gram negative aerobes did not appear as often initially, but appeared anew in a much higher percentage than in soft part wounds The sulfonamides did not particularly favor their elimination or prevent their secondary development in the wounds

The infection rate in burns is 42 1 per cent trivial infections being somewhat higher than serious ones The compression dressing method stands out as representing the greatest proportion of right principles and the lowest incidence of infection The initial dressing containing a bacteriostatic agent has a slight but not clearcut superiority over the simple nonadherent ointments The damaged tissue may contain sulfonamide inhibitors There is evidence that greater or less absorption of the drug from burned surfaces may depend on the vehicle of the sulfonamide The ideal vehicle has not yet been found The local drug action may be inhibited while the general effect may be obtained from local applications

There were two deaths in which infection played an important role but the burns were so extensive that the

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(3) Surgery 13 683 691 May 1943

sesses a fibrinolysin which permits it to dissolve human blood fibrinogen, thus interfering with one of the essential defense mechanisms of the inflammatory process, local fixation of micro organisms In cultures it produces a putrid, foul odor and together with the anaerobic Streptococcus putrificus is responsible for the unpleasant odor of some types of pus

Strains of Bacteroides melaninogenicus were recovered from human lesions which, if inoculated within a few days after cultivation, were pathogenic for rabbits and mice Intradermal injection produced in the former *intense local inflammation, dermonecrosis and occasionally* death Previous damage of the tissue by a bacterial toxin enhances the dermonecrotic properties of the germs *Use of mucin as a menstruum for suspending the* bacteria supplies them with a capsule, thus augmenting their pathogenicity and invasiveness

Bacteroides melaninogenicus like Bacteroides funduliformis and certain other members of the genus Bacteroides may therefore be regarded as an "opportunist" which must find conditions suitable for invasion and multiplication

[The occurrence of this organism in the mouth especially in many cases of pyorrhea alveolaris accounts for its frequent finding in pulmonary abscesses and other suppurative conditions of the lung —Ed]

Champ Lyons Cora R Owen and William B Ayers[4] (Massachusetts Gen l Hosp) combined surgical management with *sulfonamide therapy in the actinomycotic infections* of five patients The etiologic agent was an anaerobic Actinomyces bovis in four and an aerobic nonacid fast actinomyces in the fifth In every instance clinical improvement was noted within the first three weeks of sulfonamide treatment, but this improvement was not maintained unless the sulfonamide was continued for a considerably longer period Nine months of treatment with 4 Gm daily produced healing for two

(4) Surgery 14 99 104 July 1943

years in one patient Other patients treated with smaller doses for equal or longer periods showed recurrent ab scesses and fistulous sinuses, but all appear improved

The dramatic initial response is somewhat misleading The drugs induce a remission and apparently diminish the intensity of the recurrence, but it can hardly be claimed that the disease has been completely cured The inference as to the necessity of surgical excision of the infection is clear

[This effect of sulfonamide therapy combined with surgical man agement is interesting and encouraging but the authors are wise in expressing a caution about the cure of the disease Remissions of varying periods in this disease are well known of course—Ed]

Infection of wounds with diphtheria is rare In eight years, H Killian[4] has seen only three cases, but the incidence may increase under war conditions Since chinosol inhibits the growth of diphtheria bacilli in culture in a dilution of 1 130,000, he decided to use it locally in dilutions of 1 1 000 An elderly man had a severe ulcer in the buttock, with much inflammation, over 14 years he underwent several operations, partial excision and x ray treatment A biopsy specimen re moved because of suspected carcinoma suggested an in fection with Corynebacterium diphtheriae, which was promptly confirmed by culture The wound was treated with chinosol and healed rapidly In the case of a bullet wound of the foot infected with diphtheria, swabs rapidly became negative after treatment with chinosol, although Pseudomonas pyocyanea Bacterium coli and streptococci were present in large numbers in the in fected fragments of bone, and the foot had to be am putated A child with burns infected with diphtheria recovered rapidly after use of chinosol

In this connection, the following account of a case of *persisting diphtheria infection of a wound* and of in adequacy of antitoxin in its treatment is worth noting The case was reported by P Mangabeira Albernaz[5]

(4) Klin Wchnschr 21 36 37 Jan 10 1942
(5) Brasil med 55 217 2 3 Mar 29 1941

Man, 24, received injury to lower lip from violent blow An irregular ulcer developed, covered by a scab It was first regarded as syphilitic and he was given bi muth and 914, but the lesion persisted A year later secretion from it was examined and Corynebacterium diphtheriae discovered He had had no sore throat nor any indication of diphtheria He received 45,000 units antitoxin without result and was then sent to the author Despite local applications of gentian violet and of trypaflavine, ultraviolet and diathermy, the secretion at the end of three years still showed the diphtheria organism He was then given 208,000 units (260 cc) serum and small doses of neosalvarsan in calcium chloride and Vincent s benzosalicylate solution (the last two because of intense urticaria) Further examination revealed no bacilli but a few Staphylococcus albus Two months later vesicles and scabs reappeared Roentgen therapy was futile and the lip was then decorticated by electric bistoury Cure resulted, for four years there has been no recurrence of the lesion

[The editor has had a case of refractory chronic empyema from which the true diphtheria bacillus was cultivated Healing occurred after combined treatment with diphtheria antitoxin and irrigations with Dakin s solution —Ed]

Bacterium Necrophorus Septicemia in Man —Victor B Buhler, Clark W Seely and Dorothy D Dixon[6] (Kansas City) report two cases, Cunningham reporting the only other case the authors have been able to find In experimental Bacterium necrophorus infections in animals, subcutaneous abscesses are formed with heavy polymorphonuclear leukocytic infiltration and attempts at fibrous tissue encapsulation Subcutaneous lesions in man present a similar picture Reference is repeatedly made to the tendency to spread instead of localize, with formation of metastatic daughter abscesses in various organs such as the lungs, spleen, kidneys and liver The primary focal lesion is usually characterized by necrosis of tissue and a putrid odor Lesions in the lungs are wedge shaped with a soft central portion consisting of necrotic debris, a midzone of polymorphonuclear leukocytes and peripheral zone of hemorrhage Newly formed fibrous tissue appears at the periphery in some, while in other lesions of longer duration fibrous tissue en

(6) Am J Clin Path 1 380 386 July 1942

capsulation may be noted Emboli of the small and medium sized vessels may be present, with areas of infarction Venous thrombi are mentioned and hemorrhage in the intestinal mucosa occurs

CASE 1—The primary focus was most likely acute appendicitis associated with an argentaffin tumor Thrombosis of vessels of meso appendix and necrosis of surrounding tissue were prominent No attempt at encapsulation of the primary infection was found Metastatic liver abscesses showed areas of necrosis heavy polymorphonuclear leukocyte infiltration and encapsulation No other metastatic foci were found Extensive hemorrhage into walls of stomach and colon with areas of necrosis and vascular thrombosis may have been due in part to passive congestion, although bacteria were demonstrated in the vessels and surrounding tissue and may have been the sole causative factor

CASE 2—The patient was admitted with traumatic laceration of the perineum due to a fall on a wooden stick The local lesion was characterized by necrosis, thrombosis of vessels and heavy polymorphonuclear leukocyte infiltration There was extension of the infection retroperitoneally along the psoas muscle with abscess formation No metastatic lesions were seen Since Dack and Dragstedt have shown Bacterium necrophorus as a normal inhabitant of the large bowel, the region surrounding the anus could easily have been contaminated and the infection introduced by the injury

Necrophorus was isolated from the blood in both patients It seems certain that this organism must invade the blood stream to produce distant metastatic abscesses, but Cunningham reports the only other case of this septicemia which the authors have been able to find

Cochliomyia Americana (Screw Worm Fly) Infestation in Man—The adult fly readily mistaken for a medium sized blowfly, has a deep greenish blue metallic color with yellow orange or reddish face, and three dark stripes on the dorsal surface of the thorax However, unlike the blowfly, it is normally attracted to fresh cuts or bloody wounds rather than to purulent sores In the last few years, it has become increasingly important as a livestock pest in the Middle West and has developed its real menace to man The female fly may deposit a few hundred eggs at the rate of 60 per minute and, with the eggs hatching in about a day an untreated wound

may soon become heavily infested with maggots The young worms promptly begin to penetrate and destroy the tissues, eating in by powerful oral hoods and causing a burning, pinching type of pain, characteristic urine colored discharge and a disagreeable odor The maggot becomes full fed in 4 to 10 days, drops out of the wound, buries in the ground and after a week in the pupal stage emerges as a fly which soon mates and



Fig 34 —A few of the larvae obtained (× ½) They were so active that several crawled out of the photographic field before the picture could be taken

deposits eggs Several broods may thus develop during the summer months

R O Pearman and L Haseman[7] (St Joseph, Mo) report a case

Woman, 58, was bitten by a spider or fly on the right cheek five days before admission The following day the side of her face itched and became swollen and painful Swelling and pain increased and the night before admission, she coughed up a larva and developed a bloody discharge from nose and mouth, 10 hours before admission she noted a gangrenous area about the size of a dime at site of what she thought was

(7) Ann. Surg 117 468 472 March 1943

the original bite. The lesion was opened through the gangrenous area with a hemostat A few larvae were obtained, accompanied by about 1 oz. foul smelling serosanguineous discharge Further exploration showed many more spreading out fanwise and burrowing into the ragged, bloody and somewhat honeycombed tissue at the periphery of the lesion, 80 larvae were removed and the ragged lining of the resulting cavity was curetted down to healthy appearing tissue The cavity opened into the right nasal passage and the nasal septum was perforated Two months later the area was completely healed

The larvae are very active, of usual maggot shape, 12 15 mm long and 2 2 5 mm in diameter (Fig 34), gray white with a tint of reddish brown due to tissue exudate filling their intestinal tracts The larvae have 12 body segments, each encircled by a narrow ring of minute spines, giving resemblance to a screw The head is rather pointed and provided with an oral hood surmounted by two hooklike projections The larger end of the larva is provided with two brownish plates through which it is supposed to breathe

Gas Gangrene.—James McIntosh and F R Selbie[5] studied the effects of *zinc peroxide, proflavine and penicillin in experimental Clostridium welchii infections* in mice The substance to be tested was injected at the site of infection immediately after or at varying intervals after intramuscular injection in the right thigh of 0 1 cc of a washed suspension containing 2 or 4 billion organisms and 0 1 cc of 5 per cent calcium chloride, sufficient to kill all untreated mice within 24 hours

They found that zinc peroxide is apparently of no value in preventing development of Clostridium welchii infection when the organisms have invaded the tissues

Proflavine is of greater value than sulfanilamide and is at least as good as sulfathiazole in the local prophylaxis and treatment of the infection, and its use as a wound dressing should therefore be further explored

Penicillin injected within three hours of infection is a powerful prophylactic against the infection and is

(5) Lancet 2 750 752 Dec 26 1942

superior as such to proflavine and the sulfonamides

Champ Lyons and Cora R Owen[8] (Harvard Univ) found that the *Wilson Blair plate* is a useful diagnostic aid *in early recognition of* the presence of certain *clostridia* in wound exudates or excised tissues However, the test does not distinguish between toxigenic and nontoxigenic strains of the organism The diagnosis of life endangering gas gangrene hinges on the presence or absence of clinical toxemia and does not depend solely on the presence of clostridia

Guy A Caldwell[1] (New Orleans) has studied the *prevention and treatment of gas gangrene* in guinea pigs The disease produced parallels its clinical course in man and responds to proved surgical measures

Early radical debridement, leaving the wound open, is the most effective surgical procedure in prevention and control of gas gangrene Roentgen therapy has a barely demonstrable retarding effect on the progress of the disease and in no instance arrests or prevents it Zinc peroxide paste has a definite inhibitory action on the progress of infection, even if its application is followed by closure of the wound

When experimental wounds are inoculated with Clostridium welchii closed for one hour, then debrided, sprinkled with sulfathiazole and sutured, gas gangrene develops in most cases and is fatal Implantation of sulfanilamide sulfathiazole or sulfadiazine in experimental wounds at the same time they are inoculated with Clostridium welchii prevents development of gas gangrene in a large percentage of cases, and even when the disease does develop it progresses slowly and is seldom fatal These results are obtained even when the wounds are sutured Still better results are obtained when such wounds are debrided within six hours reimplanted with one of the drugs and again sutured The

(8) J Bact 43 685 68 June 1942
(1) Tri State M J 15 2803 ?806 October 194?

clinical implication is that unless the sulfonamides can be implanted almost immediately after wounds are contaminated with Clostridium welchii they have only a slight inhibitory effect. They are distinctly beneficial when introduced into contaminated wounds early and again after careful debridement within six hours.

Tetanus.—George H Bunch (Columbia S C) and Julian Quattlebaum[6] (Savannah Ga) report eight cases of *postoperative tetanus* which they attribute to the use of unsterile goods or instruments at operation. Although the condition is more common in hospitals having substandard equipment, it also occurs in those having the best. This results from inability to sterilize the skin through which the incision is made and from fallibility in the operation of the sterilizer. Color change from heat in commercial sterilizer controls is unreliable in that it does not prove contact with steam. The sterilizer should be inspected regularly for mechanical defect, and goods should have monthly bacteriologic tests with spore forming anaerobes. The services of a competent bacteriologist should be available to every hospital. If sterilization of goods and instruments cannot be relied on prophylactic antitoxin should be given after every operation. Instruments should be sterilized by steam under pressure and not by boiling. Without wound suppuration and without peritonitis the laparotomy patient may die of infection by anaerobic spores, a tragedy which absolute sterilization would prevent in most cases.

A case of *probable tetanus despite inoculation with toxoid* is described by R J McGill[2] (Indian M Service).

Native youth 20, inoculated subcutaneously with 1 cc tetanus toxoid Apr 25 and June 7 1941, received two small incised, superficial wounds of the left hand on November 18 and was admitted December 4 with a history of suspicious symptoms for two days. The wounds were healed. Moderate

(6) Am J Surg 61 80 85 August 1943

( ) Brit M J 1 40 41 Jan 9 1943

risus sardonicus and trismus were present, the jaws opening ½ in There was marked stiffness of the back and neck, abdominal muscles were rigid but moved with respiration Spontaneous paroxysms of opisthotonos, occurring every half minute, lasting five seconds and accompanied by clenching of the jaws and spasm of the thoracic and abdominal muscles, first appeared the night of December 3 He was rational but his face bore an appearance of intense anxiety Abdominal reflexes were absent

He received 15,000 units A T S (therapeutic) the previous day and 15 cc intravenously and 5 cc subcutaneously with adrenalin and calcium lactate earlier on the day of admission In the hospital he was given 40,000 units (therapeutic) intramuscularly twice daily and was kept stuporous with paraldehyde, 4 drachms by mouth, repeated in 2 drachm doses when necessary, day and night

The morning of December 5 temperature was 99 4 F, pulse 90, respirations 20, and his condition unchanged The next day the spasms were of five seconds duration as before, but occurred only every two minutes and severity was much less marked Neck rigidity and trismus were unchanged, and temperature was 100 F Treatment was repeated Early the next morning he suddenly died Temperature had just been taken —99 F

Diagnosis of tetanus was not confirmed bacteriologically, but the other possibilities, rabies and strychnine poisoning, were positively excluded No other case of tetanus was reported in the area during eight months of British occupation The country is dry, sandy, hot and arid, and tetanus is rare in such soils However the Italians left the site of occupation in a filthy condition, and there had been much recent contamination of the soil by horse, mule and donkey manure No A T S had been given at the time of the injuries, the patient considering them too trivial to report

Despite improvement after admission and until the moment of death, which was due to rupture of the pulmonary valve cusp the ultimately fatal issue agrees with Cole s gloomy prognosis in cases in which spasm begins in 48 hours after onset of trismus

The mere fact that the wounds in the left hand were healed does not invalidate the diagnosis Such a case vindicates the present practice of giving antitoxin to all wounded regardless of previous inoculation with toxoid

The use of curare in a case of tetanus is reported by Stuart C Cullen and C S Quinn[7] (State Univ of Iowa)

The patient was given 20,000 units tetanus antitoxin intra muscularly and 30,000 units intravenously on the night of admission, followed by 50,000 units intravenously the next day The small local lesion was opened, debrided and dressed with zinc peroxide paste For the first 48 hours the patient was given avertin per rectum The degree of relaxation of the abdominal wall was used as a guide to dosage Despite marked general depression, intermittent spasms of the entire body still occurred, with clonic jerking of the extremities There was considerable respiratory depression, obstruction and mucus production The latter was somewhat controlled with atropine

The patient was developing pneumonia Use of avertin was discontinued and curare given intravenously or intramuscu larly After the depression from avertin had disappeared and the patient was conscious, the curare effect was spectacular At the height of a spasm when he had excruciating pain, the intravenous injection produced marked relief in a few seconds, the jaw relaxed, opisthotonos disappeared, the respirations became easier and he was able to cough, expectorate, drink and move about in bed The day after discontinuance of aver tin, the temperature fell and respirations became slower No specific therapy or chemotherapy was used for the pneumonia

As with avertin, the frequency of administration of curare was determined by the tone of the rectus abdominis There seemed to be much variation in the length of the intervals between attacks and in their duration and severity However 50 mg curare would usually keep the patient comfortable and free from acute spasm for about three hours

On the seventh day the supply of curare was exhausted and treatment was continued with beta erythroidine, a drug similar to curare in action Three hundred mg of a 10 per cent solu tion produced approximately the same effect as 0 050 Gm curare With injection of beta erythroidine, the patient ex perienced a slight feeling of faintness On two occasions there was momentary fall in systolic blood pressure of about 30 mm No fall in blood pressure was observed when curare was used

Beta erythroidine was not needed after the ninth day, when the spasms were no longer severe enough to endanger the patient s life or even discomfit him He was then given 4 5 gr phenobarbital daily, in divided doses

Nutrition and hydration were maintained by giving fluids intravenously and a liquid diet The generalized hypertonicity

(7) Surgery 14 256 260 August 194

was slow in leaving and was still present to sou the patient was discharged on the eighteenth d

Since beta erythroidine was used in the t of the disease little can be said about the r tiveness of this drug and curare The circ pressant effect of the former which was ev case is undesirable

[It is possible that curare will find a definite plac ment of the spasms of tetanu Many favorable resu reported —Ed]

Shock —*In a study of the therapy of shock mental animals* F L Muirhead C T Ashw Kregel and J M Hill[6] (Baylor Univ) com effects on the circulation of glucose saline dil and concentrated serum on the basis of volume total protein injected They found the followi ing order of efficiency glucose saline soluti serum smaller volume concentrated serum amount of protein dilute serum larger vol concentrated serum larger amount of protein

Concentrated serum produced consistently n fluids from the tissues into the blood stream T shift reversed several of the abnormal mechan curring in the capillaries The most important f *the therapy of shock* appears to be the total am proteins administered

Robert Elman[3] (Washington Univ) states th *protein deficiency* is a decisive factor in the patho of *surgical shock* and clinical manifestations severe hemorrhage burns intestinal obstruction an eral peritonitis Hypoproteinemia confined largely albumin fraction is but one aspect of this deficien though it may be masked by dehydration This p defect in severe cases cannot be corrected rapidly by the body and therefore requires prompt replac therapy Because of its protein content, plasma fective if given early and in large enough amounts

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(3) J A M A 120 1176 1180 Dec 1 1942

protein amino acids offer another way of meeting protein deficiency This new method of therapy has been shown to correct chronic hypoproteinemia of nutritional origin, early trials in acute hypoproteinemia have yielded promising results

[Dr Elman s pioneer work in the parenteral administration of amino-acids is of major importance For the first time a method became available for giving protein food intravenously in an easily assimilable form —Ed]

William Thalhimer[4] (New York City) considers whether *intravenous injection of pooled normal plasma or serum* is dangerous Extensive clinical evidence demonstrates that, in pools of a sufficient number of samples of plasma or serum obtained from donors belonging to the four blood groups the titer of both anti A and anti B agglutinins is reduced to such a low level that no danger can result from intravenous injection of even large therapeutic doses from these pools

Robert Elman and Carl F Lischer[9] (Washington Univ) made an *experimental study of amino acids, serum and plasma in replacement therapy of fatal shock due to repeated hemorrhage* in dogs

Fatal surgical shock in unanesthetized dogs followed bleeding of 10 cc per Kg body weight every hour, the mean survival time being 3 6 hours There was progressive fall in blood pressure red cell volume and plasma albumin and globulin in all experiments If the blood removed each time was immediately replaced by the same volume of various solutions, significant differences were observed

The survival time was unchanged with glucose in saline and increased to 4 2 hours with pure amino acids and to 5 15 with hydrolyzed protein With citrated plasma or serum, survival time was but 4 5 and 4 6 hours whereas with heparinized plasma it was 6 hours

The fall in blood pressure was greater with citrated plasma and serum than with heparinized plasma

(4) J A M A 120 1263 1266 Dec 19 1942
(9) Ann Surg 118 5 37 August 1943

whereas hydrolyzed protein produced less hypotension than was produced by use of glucose in saline

Study of the changes in red cell volume and plasma proteins gives some indication that the amino acids of hydrolyzed protein were converted into plasma albumin Histologic study of the liver suggests that protein is lost from the hepatic cytoplasm in hemorrhage and that injection of hydrolyzed protein replenishes this loss, as compared with experiments in which glucose was used

It may be inferred that in shock due to repeated hemorrhage a solution containing the amino acids and peptides of hydrolyzed protein has a beneficial influence as compared with glucose and that heparinized is far superior to citrated plasma

Certain additional clinical implications may be drawn from these data In many instances, hemorrhage will be accompanied by considerable trauma Whether this is the result of accident or planned operative procedure there is increased nitrogen loss indicating excessive tissue protein breakdown When there is acute loss of protein, as in hemorrhage, the body stores will attempt to replenish this loss at their own expense thus adding to the depletion of tissue protein To replace protein lost from the circulating blood is a simple problem and can be accomplished directly with whole blood or plasma But correction of tissue protein depletion is easier and more direct with amino acids than with plasma, even when large amounts of the latter are given Thus, in the severely wounded or severely depleted individual, nitrogen metabolism can be restored to normal more readily by using protein hydrolysates and so accelerate recovery Moreover, if whole blood or plasma is not available, it would seem that protein hydrolysate is preferable to ordinary crystalloid in the treatment of shock due to hemorrhage

F W Hartman, Victor Schelling Brock Brush and Kenneth W Warren[1] (Henry Ford Hosp) discuss the

(1) J A M A 1?1 133 1342 Apr 24 1943

relative value of pectin solution in shock Pectin furnishes a readily available source for colloidal solutions which may be prepared economically The pectin molecule contains no protein, and the solutions give few if any reactions if the method of preparation is correct Solutions prepared by multiple filtration and heating for 15 to 18 hours are preferred Good solutions should be water clear and have a viscosity of 2 to 4 at 38 C and an osmotic pressure of 45 to 70 mm Hg, depending on the percentage of pectin of 0 75 to 1 5 The molecular weight may vary from 60,000 to 75,000

In animals, the 0 75 per cent solution is well tolerated and more efficient in replacing blood loss than electrolyte solutions In patients, its intravenous injection tends to increase the systolic and diastolic blood pressures, while the blood volume is increased and well maintained The solution has been used in 125 clinical cases as a substitute for electrolyte solutions, blood and blood plasma in prevention and treatment of shock, traumatic or surgical, with satisfactory results

Experience has shown that 5 10 cc a minute can be maintained in the average patient without subjective symptoms As with cold bank blood, pectin solution may be given faster if the situation demands it

W M Parkins, C E Koop C Riegel H M Vars and J S Lockwood[2] (Univ of Pennsylvania) investigated *gelatin as a plasma substitute in dogs with particular reference to experimental hemorrhage and burn shock* The gelatin used was supplied as calcium gelatinate produced by hydrolysis of alkali treated bovine long bone collagen under controlled and standardized conditions The laboratory preparation was a 6 per cent solution in 0 85 per cent saline, sterilized by autoclave at 15 lb pressure for 20 minutes it is stable for months when stored at 4 C After autoclaving the solution has a pH of 6 specific viscosity of 1 6 at 37 C, specific gravity of 1 024 and osmotic pressure of 46 to 48 mm Hg Infusions

(2) Ann Surg 118 193 214 August 1943

were made by needle puncture through the jugular vein, and the solutions were kept at 32 to 37 C and administered at the rate of 0 5 to 1 cc per Kg per minute

Normal dogs tolerated repeated infusions of large volumes of the solution without any serious toxic reactions specific to gelatin Unfavorable reactions that did occur were reversible and frequently produced by *infusions of comparable amounts of saline or plasma* Pseudo agglutination of erythrocytes and increase in sedimentation rate, which also occur following infusion of other macromolecular colloids were observed in vitro and in vivo following infusions of gelatin Bromsulfalein retention occurred after repeated infusions, but is present to some extent in dogs given infusions with comparable volumes of plasma Other liver function tests were essentially negative Kidney function as determined by urea clearance, was seemingly unimpaired after single and repeated infusions Tissue changes observed histologically were reversible and slightly more marked with gelatin than with plasma infused in equivalent volumes and under similar conditions No chronic tissue storage was observed in animals which received repeated infusions of large volumes of gelatin A transient diuresis and excretion of gelatin followed its infusion in normal dogs and dogs subjected to preliminary hemorrhage *About half of the gelatin infused was accounted for by* urinary excretion

Following massive rapid hemorrhage and immediate infusion of gelatin the plasma proteins were apparently replaced at about the same rate as that at which the gelatin protein disappeared from the blood stream

All dogs survived a rapid massive hemorrhage to point of respiratory failure and blood pressure levels of approximately 20 mm Hg when given immediate infusion of either saline or gelatin The higher total protein concentration following gelatin infusion the considerably greater hemodilution and the more rapid return of the blood pressure to normal strongly bear out

the superiority of gelatin over saline infusions in the management of experimental hemorrhage of this type

The resistance of the dog to repeated massive hemorrhage followed by gelatin infusion is markedly increased over that of the animal similarly bled and given infusions of saline The saline infused dog in which the blood pressure continued to decline and remained at critical levels for hours following repeated infusions completely recovered on subsequent infusions of gelatin

Following a slow three stage hemorrhage with blood pressure maintained at 30 to 40 mm Hg for 30 to 40 minutes, all untreated dogs died within a few hours Although elevation of plasma volume and blood pressure were not marked or well maintained after infusion of saline, compensation occurred and two of five dogs slowly recovered, while three died in two to six hours Gelatin infusion resulted in a more marked hemodilution than did plasma infusion under uniform volume replacement The blood pressure was restored and maintained at approximately the same normal levels with gelatin as with plasma, and all dogs made a rapid, complete recovery Under these conditions of experimental hemorrhage, gelatin appears to be a suitable substitute for plasma

In eight dogs subjected to standardized reproducible burn of a degree fatal to untreated and to most saline infused animals, gelatin solutions compensated for the loss of plasma from the blood stream and corrected hemoconcentration to the same degree as did plasma infused in four animals Although survival was extended in the burn shock gelatin group beyond the period when death occurred in controls, presumably from hemoconcentration seven of eight dogs died after progressive decline in the blood pressure unassociated with hemoconcentration Under identical conditions with plasma infusion only one of four dogs died

If a factor can be identified in plasma which accounts for its ability to maintain blood pressure in the severely burned animal during the secondary phase of so called

"acute toxemia," the addition of this factor to gelatin would probably result in a more adequate plasma substitute for burns

[The idea is a logical one It was proposed about 30 years ago by Hogan of Vallejo, Calif and tried out successfully in experimental shock in animal The chief trouble at that time however was the difficulty in obtaining a sufficiently pure product and one that was not too acid With better preparations available it seems probable that a place will be found for gelatin as a substitute for human plasma—Ed]

Jacob Fine Arnold M Seligman and Howard A Frank[3] (Harvard Univ) used plasma proteins tagged with radioactive isotopes to study the capillary leakage hypothesis in *traumatic shock* (hemorrhagic, tourniquet and burn)

No evidence of leakage due to a change in the permeability of the general capillary bed was found Tagged plasma proteins escaped into areas of injury in considerable amounts, but not into untraumatized areas

There is no evidence to show that the general capillary bed becomes more permeable to plasma proteins or plasma in the late or irreversible phase of shock Data obtained by use of radioactively tagged red cells injected intravenously, combined with tissue analyses for hemoglobin and tagged red cell content, indicate that about one fifth of the capillary blood becomes stagnant or trapped out of active circulation as the shock phase deepens The progressive decline in shock is not due to a progressive fall in plasma volume but to a progressive fall in the volume of actively circulating plasma The blood content in cubic centimeters per gram of tissue is not more and is generally the same, or less in shock than it is in normal dogs

The therapeutic problem in shock after adequate replacement of lost blood or plasma has failed is one of restoring volume and velocity flow through capillaries before the integrity of vital tissue processes is inevitably lost

(3) *Ann Surg 118 38 ?55 August 1943*

Reduced Temperatures in Shock Treatment —Experiments of Frederick M Allen[4] (New York Med College) showed that local refrigeration, which was formerly found effective for preventing shock, is also helpful in the treatment of shock originating from the limbs and presumably other bodily areas which can be efficiently chilled Survival of shocked dogs is lengthened by simple refrigeration of the injured legs, and still more by prolonged or intermittent tourniquet application with refrigeration

The essential therapeutic effect of these measures is retardation of the shock process affording a greatly lengthened time for other treatment and better ability to respond to it Within limits, the lengthened survival can be converted into permanent recovery by the simple administration of fluids by stomach or salt solution subcutaneously

Simple local refrigeration is harmless The only danger from the most prolonged tourniquet application with refrigeration is thrombosis Certain rules are provisionally suggested for conservative clinical application of these methods for shock and complications, with a particular view to military uses at present

1 A tourniquet should not be used without positive indication or planned purpose One example is a permanent tourniquet to be left in position until after a hopelessly mangled limb has been amputated

2 The only indication for a temporary tourniquet at ordinary temperature is uncontrollable hemorrhage The limb should then be kept at the lowest temperature that is feasible without freezing At certain intervals the circulation should be restored either momentarily or for a time governed by the effectiveness of local pressure for controlling bleeding The time limit of continuous tourniquet application should be half an hour in summer weather and longer in proportion as the temperature is lower

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(4) Am J Surg 60 35 348 June 1943

3 If refrigeration is available, it is a safe aid for inhibiting some degrees of shock, more or less superficial infections, etc, without a tourniquet Temple Fay has emphasized its value in gas forming infections

4 A tourniquet may be used with refrigeration for controlling hemorrhage or more severe shock, infection or pain or for anesthesia preparatory to operation The safe time of application to a wounded limb is at least three or four hours and probably much longer, depending partly on the character of the wound

5 For extreme emergencies of shock or wounds which might require ligation refrigeration for 10 to 24 hours or longer, the use of heparin may assure safety because animal experiments indicate that there is no danger except thrombosis

6 If the shock or other emergency is serious enough to threaten life the tourniquet and refrigeration can be used for the longest times without heparin There is a fair chance of absence of harm but if thrombosis occurs amputation can be performed without other anesthesia and life can be saved at the cost of the limb

Investigation of systemic hypothermia was left unfinished and the conclusions are limited to a warning against misuse of artificial heat and a suggestion of the advantages of slightly subnormal temperature Extreme measures should be held in abeyance until they can be tested by further research

Investigating the *role of the nervous system in shock,* Dallas B Phemister[a] (Univ of Chicago) produced neurogenic shock by prolonged electrical stimulation of the cardio aortic (aortic depressor) nerves of the rabbit resulting in marked and prolonged lowering of blood pressure hemodilution anoxia and terminal exhaustion of the vasomotor center of the medulla Usually there was a lapse of four to seven hours before serious impairment of the vasomotor center and of five to eight hours before death Removal of the stimulus before serious impair

(a) Ann Surg 118 256 68 August 1943

ment of the center was followed by rapid recovery of the circulation In exceptional experiments, the blood pressure was maintained at low levels and the course was more rapid The results serve as an index of the effect of hyperactivity of afferent vasodepressor impulses which would be the same regardless of the pathways over which they came to the medulla The possibility that shock is ever produced by accidental injury of the cardio aortic nerves is so small that it scarcely merits consideration Blood and plasma transfusions improved the condition of the shocked animals

In dogs with section of the seventh cervical segment of the spinal cord a remarkably severe and prolonged lowering of blood pressure resulted before failure of the circulation and death These results demonstrate the marked capacity of the circulation to remain adequate when the blood pressure is lowered principally by interference with vasoconstrictor nerve impulses to the blood vessels with relatively little associated blood loss

Nothing remotely approaching this degree and duration of lowered blood pressure and failure of the circulation has been produced by direct stimulation of the somatic nerves Consequently it is highly improbable in accidental and operative wounds that shock ever results primarily or even secondarily from the action of afferent vasodepressor impulses passing over the somatic nerves that are injured in the field

Vasomotor and cardiac afferent depressor impulses from the brain to the medullary center may lower blood pressure and produce syncope but they act for too short a time to be the sole cause of shock in comparison with the long time required for its experimental production from an equally marked lowering of pressure by aortic depressor nerve stimulation The same is true of the occasional reflex lowering of pressure in abdominal operations However, when combined with hemorrhage, these may be contributing factors in shock production as were vasodepressor impulses from cardio aortic nerve

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(5) Ann Surg 118 [illegible] 6[illegible] August 1943

Wounds resulting from burns differ from soft part wounds in many respects As a rule, they are more extensive, cause more damage to the skin and expose a greater surface to contamination But this injured surface is at first sterilized by the heat producing the burn and offers better opportunity to avoid contamination if a protective covering is provided in the initial treatment In burns with areas of total destruction of the skin, gangrene of tissue takes place which has to be sloughed off before repair by granulation and epithelization can occur If these areas are extensive infection, anemia, hypoproteinemia and nitrogen imbalance develop There is a marked increase of the capillary permeability in the periphery of the burned area and of the rate of lymph flow away from this zone But more important, there is marked delay in production or liberation of thrombo plastic substance in the burned area as compared with that found in crushed tissue or soft part wounds

After 8 to 10 hours, lymph flow begins to slow down as a result of coagulation of blood and lymph in the injured tissue Were it not for this excessive flow of lymph and interstitial fluid away from the burned area, much more marked edema would result The lymph recovered from a burned area contains a strong vaso constrictor substance May this not be a definite cause of the secondary shock that appears in extensive burns within the first 10 hours? This increased lymph flow is of great significance in delayed localization of infection and shows the importance of precautions against early contamination

Drinker has demonstrated that if an animal's paw after exposure to boiling water is immediately encased in a plaster of paris jacket edema does not occur and therefore the lymph flow is markedly decreased This means a great reduction in the plasma loss from capillary leakage into the interstitial tissue spaces and a corresponding lack of shock due to plasma loss Gangrene

stimulation when preceded by hemorrhage to shock levels

A fuller realization of the relatively small importance of hyperactivity of afferent depressor nerve impulses and of the relatively great importance of blood and plasma loss and toxicity of anesthetics in the causation of surgical shock will lead to greater attention to the latter factors and to further improvement in surgical therapy The primary cause of shock is probably never a purely reflex vasodepressor reaction

Burns —Allen O Whipple,[6] Chairman of the Subcommittee on Burns of the National Research Council (Presbyterian Hosp, New York City), discusses the *basic principles in treatment of thermal burns* Global mechanized war has resulted in an unprecedented number of these burns, with a demand for an immediate answer to the debatable question of how best to treat them The disagreement regarding the best therapy is due to a number of factors failure to understand the underlying pathology and disturbed physiology of the burned individual and the differences in the wound caused by a burn and soft part wounds, failure of those reporting results of various types of local treatment to differentiate between second degree and third degree burns the latter and the mixed second and third degree burns being the criteria by which every therapy should be judged failure to appreciate the importance of trained and experienced groups of individuals interested in care of burned patients failure to appreciate the importance of timing in the sequence of events in the pathogenesis, symptomatology and treatment of severely burned patients The one outstanding contribution to burn therapy in preventing and combating shock is use of plasma instead of salt solution and whole blood Introduction of sulfonamide therapy in treatment of burns has caused more confusion than benefit because many looked on it as a panacea

(6) Ann Surg 118 187 197 August 1943

With further study, a number of new and fundamentally important problems will modify and improve treatment of the burned patient One is the problem of nitrogen imbalance Another is the discovery of a fluid containing protein and electrolyte of proper molecular make up, that can be used as a substitute for plasma with all its advantages Recent experimental work in oral sodium therapy by Rosenthal promises interesting results in clinical cases but there are many phases of this subject such as the relation of serum protein loss to sodium loss and intake that need much more study before the experimental results in animals can be correlated with clinical results

Charles C Trabue[5] has used the *triple dye method in treatment of burns* at the Nashville General Hospital with results superior to those obtained with previously used routines

PROCEDURE—No matter what first aid treatment has been given or how long it is before the patient reaches the hospital even several days, the patient must be taken to the operating room and anesthetized and the wound cleansed and tanned No part of the treatment is more important than the cleansing no matter what chemical agent is to be used Failure to do this properly often leads to infection and pus under the coagulum with toxemia and sepsis Many patients are lost because of this failure and healing is greatly delayed in those who survive

After the wound has been cleansed, the dye is applied The formula used by Wakeley is gentian violet 1 400 brilliant green 1 400 and neutral acriflavine 1 1,000 The solutions are mixed in equal proportions in distilled water and are considerably more stable than tannic acid solution There are several other formulas in general use and one or more of these dyes have been mixed with tannic acid Ointments and jellies are made, particularly with gentian violet usually 1 per cent The dye may be applied with an atomizer or spray, camel s hair brush or gauze mop It is better to extend the dye over a small area of normal skin than to leave any of the burned area uncovered An electric hair drier is excellent for drying the dye quickly When dry a light flexible tan or coagulum is formed, which in first and second degree burns remains

(5) J Tenn ce M A 3 13 19 Ja uary 1943

of the tissues is also far less than it is in the control

Considering these essential characteristics of the pathology of burns the basic and simple principles of therapy may be summed up as follows The most important early general complication is plasma volume loss as a result of plasma leakage into the interstitial spaces This can be largely prevented by firm pressure bandaging and controlled by plasma transfusion Prevention and treatment of shock in every severe burn should precede any definitive treatment The most important local complication is infection As the burned surface is initially sterile every precaution should be taken to prevent contamination This can be accomplished principally by adequate masking of nose and mouth and surgical asepsis in applying the initial dressings and by leaving the wound undisturbed thereafter unless infection is evident This initial dressing should be a fine meshed gauze or tulle gras impregnated with or covering a bland simple ointment or solution that will not damage the remaining epithelium The subsequent dressings will depend on the degree of skin damage If total skin destruction has occurred dressings to favor removal of the slough as soon as possible with skin grafting of the entire denuded granulating area at the earliest favorable time are the essential considerations Any form of treatment which tends to seal in infection and causes a delay in skin grafting is to be condemned Here more than in any other type of burn proper timing is the secret of success

In estimating the relative efficacy of any new or old treatment results in total skin burns should be the criterion A number of new and old methods of local treatment are being carefully studied in clinics where burn projects are functioning These include sulfonamide creams and ointments films of several kinds with and without sulfonamides paraffin spray and ultracentrifuged finely divided particles of clay known as bentonite made into water soluble colloidal gels

face of a burn and follow intimately its delicate contours, they adhere closely, remain transparent, permitting observation of the healing process, and are easily removed by simply sponging with water If excessive oozing threatens to disintegrate the film, a second or third layer can be applied over the first, thus restoring strength of the membrane Mounting the films on gauze gives them additional strength, and they can be made into sheets large enough to encircle the adult torso The membranes contain 10 per cent sulfanilamide and buffer, with or without azochloramid

The burn is debrided and cleaned with a solution of sodium chloride, boric acid or azochloramid and sodium chloride under sterile precautions All dead skin is removed at the first treatment Cultures and smears are taken and the preformed membrane is applied directly to the raw oozing surface A dry sterile dressing is placed over the membrane and held by plain gauze bandage

If any small moist areas remain after the membrane is removed, they are dusted with buffered sulfanilamide powder and a dry dressing is applied

Since this report was submitted, 10 additional patients were treated, including a child of 15 months whose burn involved 55 per cent of the surface of the body and a Negro, 21, with 35 per cent of body surface involved Both were completely healed in 12 days Average healing time was nine days

Skin Grafting —P Gabarro[6] (Barcelona) uses a *new method of grafting* based on the following rules to which in his opinion, the ideal graft must conform Plenty of room must be left between the grafts for possible discharge The donor area must not be spoiled, so that it could be used again and again The graft should take easily—as well as or better than any other graft The technic must be fairly rapid in use and the number of grafts unlimited Contact, direct or indirect must be avoided between donor and recipient areas The space between the grafts must be less than the possible easy and early spread of the epithelium

TECHNIC —A graft of the desired thickness and from one sixth to one ninth of the raw area to be covered is cut from the donor area It is placed on stiff sticky paper such as the

(6) Brit M J 1 7 3 4 June 1? 1943

until the underlying area is healed In third degree burns the tan usually separates at the end of 10 days or 2 weeks and a clean granulating surface is presented This should be treated with dressings kept constantly moist with sterile saline for a day or two and then a graft applied Too much cannot be said for the value of skin grafting at the earliest possible date The dye is reapplied every successive day for five days, with particular attention to any cracks or fissures or moist areas which may occur The strictest aseptic precautions should be taken at all times No dressings are applied, but the patient is returned to bed and covered with a heat cradle, except for the head The burned areas should be protected from the sheets with sterile towels

The triple dye was first substituted for tannic acid because of its antiseptic action The tan formed is not so thick or so inflexible as that of tannic acid, and it can be separated from the wound more easily and with less destruction of underlying tissues It is seldom nec essary to use soaks in removing the tan Its flexibility is also an advantage The coagulum is not strong enough and is too elastic to cause necrosis, but it is safer never to produce one which completely encircles an extremity or a digit The triple dye or gentian violet alone is ideal for facial burns

No first aid treatment is necessary for patients taken immediately to a hospital, but if hospitalization is not immediately available, preferred treatment is applica tion of a liberal quantity of 1 per cent gentian violet ointment, covered with sterile gauze dressings

William DeW Andrus William F Nickel and F C Schmelkes[6] used *chemotherapeutic membranes in treat ment of second degree burns* of the last 10 consecutive cases in New York Hospital Five patients required hospitalization, the others were ambulatory An average of 12 4 days was required for complete epithelization

Technic —The membranes are prepared from a hydrophilic cellulose derivative in which the various chemotherapeutic agents are incorporated The transparent thin, light tough films become pliable when placed in contact with the moist sur

(6) Arch Surg 46 1 8 January 1943

on the denuded skin area and carefully fitted with forceps To coagulate the thin layer of plasma, hot compresses (at 50 C) are applied with gentle pressure, renewed frequently and maintained for 5 to 10 minutes No dressings are used except one thickness of vaseline gauze to protect the tissue from infection no stitches are necessary A cork ring is placed over the gauze to protect the operative field from trauma and this is held in place by adhesive tape After 24 hours the site of the graft is inspected any serum which has accumulated around the edges gently wiped off and the protective covering reapplied for 48 hours to 7 days depending on size and location of the graft Within 48 hours the graft has become vascularized and assumes a normal, healthy color

D O Brown[8] (M C , R A) recommends *the use of direct skin flaps* in recent injury with extensive skin loss in regions of great functional significance such as the hand, forearm or elbow, and in old unhealed wounds or wounds healed with tissue loss and contracture in regions of great functional significance, or overlying bone or tendons or in weight bearing regions In the main losses of the skin of the hand, forearm and elbow are replaced from the skin of the abdominal wall Flaps may be cut with the attached base upward or downward, or less commonly the double ended strap flap is used Losses of the skin of the lower limb are dealt with by the crossed leg method, with its almost unlimited variety of design Occasionally less usual procedures may be desired, such as the attachment of a finger to the chest wall or thigh

TECHNIC —Planning is done with jaconet, patiently and carefully and with adequate assistance Usually, the first pattern is made with the patient in bed, and the general operative procedure is decided on On the day before operation, the patient is taken to the operating room and placed in the position he will occupy on the operating table The plan is reviewed and perhaps altered radically, for sometimes a design which appears satisfactory with the patient hunched up in bed is quite impracticable when he is placed on the operating table

Fixation after operation is of the first importance In abdo

(8) Brit J Surg 30 30 314 April 1943

gross sterile paper supplied with boxes of tulle gras or any other material of similar qualities and skin and paper are cut in strips as thin as convenient The strips are again placed on the same type of paper, at the distances desired and the graft and the two thicknesses of paper are cut at right angles to the first series of strips This gives strips of paper with square grafts well spread and evenly spaced The strips may, of course be cut narrow or wide triangular or any desired shape Ten cuts in one direction and 10 in the other will give 100 grafts which can be arranged in checkboard fashion, a square a cross or any other shape

Gabarro has used this type of graft only when the usual graft has failed when the condition of the raw area made it unsafe to use an ordinary graft or when there was much limitation of the donor area Some of the cases were clinically poor It is too early to draw final conclusions but results have been striking He reports a case of third degree burns 5 weeks old in which the time from operation to complete epithelization in three areas was 17 days The first dressing was done on the seventh day after operation The grafts had all taken but there were still no signs of epithelium growing from the edges Ten days later the whole area was covered with epithelium

The surface area of the graft was less than one tenth of the grafted area which means that in 10 days the epithelium had grown at a daily average of 100 per cent of the original graft

Machteld F Sano[7] (Temple Univ) presents a *new method for skin grafting* which depends on the use of a thin coagulum of autogenous plasma for fixation of the graft When the technic is properly carried out there are 100 per cent takes

TECHNIC —When healthy granulation tissue has formed on the denuded area a full thickness skin graft is taken under the usual aseptic precautions and excessive fat is carefully removed from its under surface The graft site and the under surface of the graft are painted with 1 or 2 drops of the previously prepared heparinized plasma and the graft is placed

(7) Am J Surg 61 10 106 July 1943

Harry F Moel, Jr[9] (M C, U S A) used *refrigeration anesthesia in skin grafting* in 27 cases requiring small or multiple small split thickness skin grafts

TECHNIC—Two hours before operation, one or more uncovered ice bags are applied directly to the donor area As slight pressure deepens the anesthesia, the ice bags are tied or bandaged in place In hot weather they may have to be refilled, but as a rule they are not disturbed until the surgeon is scrubbed and ready to prepare the skin The maximal anesthetic effect lasts about 20 minutes after the ice bags are removed

Preoperative medication is usually not necessary but may be helpful It was used only for apprehensive patients, who were given morphine sulfate one half to one hour before operation

Complete anesthesia was obtained in 24 patients The other three complained of a burning sensation when the graft was cut but it was not sufficiently acute to necessitate another form of anesthesia In each of these cases, the full two hours had not been allowed for chilling Refrigeration does not noticeably affect the growth of the graft or the repair of the donor site

Forrest Young[7] (Univ of Rochester) presents a preliminary report on *immediate skin grafting in treatment of burns* The ideal treatment of burns should restore lost plasma, prevent further plasma loss, prevent absorption of burned tissue forestall infection and promote primary healing A first or second degree burn, given proper care, heals per primam A third degree burn, under former methods, heals only by second intention, but primary healing of the entire wound may be obtained by immediate cleansing and complete debridement, with immediate grafting of deeply injured areas and application of usual compression dressings over free grafts, associated with immobilization of adjacent joints by plaster cast applied directly over the dressing Young reports a successful case

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(9) J A M A. 122 597 598 June 26 1943
(7) Ann Surg 116 445 451 September 1942

men to forearm flaps, elastoplast provides the most convenient and best means of fixation It allows altering the relations of the forearm and abdomen after a few days when the viability of the flap is well established and its base can safely be kinked back to wrap the flap around the arm closely, as far as and beyond what will be the final line of attachment In the case of crossed leg flaps plaster should almost always be used On the day before operation, with the patient in the position which he will occupy after operation, three separate sections of plaster are applied, e g, around both thighs and one leg The legs should be washed thoroughly with soap and water but not shaved so that the nonpadded casts will adhere to skin and hairs Change of posture is avoided as far as possible during drying of the plaster After operation, the three sections are joined by a triangle of stout plaster rope, while the limbs are held in the required position by an assistant It is often advisable to remove one section of the plaster after 7 days and the remainder after 14 days

Transference of the skin by the direct flap method requires two operations with an interval of three to five weeks The order of procedure at the first operation is (1) establishment of the defect, (2) final designing, (3) cutting of skin flap (4) sewing in of skin flap, (5) grafting of secondary defect if required, (6) fixation at the second operation, (1) division of flap, (2) sewing in of base, (3) repair of secondary defect

A regular defect preferably rectangular, should be established without irregular projections and angles The flap should be cut with bold straight incisions and the undermining done with sweeping knife cuts preserving the same thickness throughout Particularly should "tailing off" of the edges be avoided The thickness of the flap will depend mainly on site and condition of the recipient area The flap must be handled carefully and absolute hemostasis is essential In most cases, the flap is sewed in along three sides of the rectangular figure or the equivalent in case of an oval or irregular design Usually about 2 5 cm of unattached bridge is required at the base and tension must be avoided Drainage with corrugated rubber or twisted silkworm gut may be advisable for a few days

The flap should be examined within a few hours of operation and watched closely afterward Sutures are removed in three to five days and massage can be started, as a rule, a few days after operation Bacterial cultures are advisable prior to division of the flap The presence in granulating areas of hemolytic streptococci or Bacillus pyocyaneus will sometimes justify delay to allow further cleansing and application of sulfonamide powder

cians reporting deaths from pneumonia Since the present fatality rate of pneumonia is about 10 per cent, it may be estimated that there is 1 sulfonamide death for every 1,610 pneumonia cases in which sulfonamides are used These numbers are believed to be as near the actual incidence of death from sulfonamide toxicity as one may approach by ordinary methods of reporting at this time Difficulties encountered in making positive assertions as to causes of death in such cases are illustrated by the necessity for considering the diagnosis as well established in some cases and merely acceptable in others Such difficulties must often deter physicians from reporting sulfonamide toxicity as a cause of death It was therefore assumed that reporting would be incomplete, and this assumption was substantiated by the results of a questionnaire The incidence of sulfonamide toxicity associated with death as found here is an improvement on previous data because of the relatively large numbers involved, and it is therefore useful despite its known incompleteness as a basis for discussing the present significance of sulfonamide deaths These data will also be of value as a comparative figure for other similar studies

This study of fatal toxic reactions presents no evidence that would modify the course pursued in the routine use and further experimental application of sulfonamides The benefits derived from this course are much greater than the risk of serious toxic reactions incurred

Morris A Simon and Marl Kaufmann[2] (Montreal) report a *death following sulfathiazole therapy*

Man, 44, admitted for incision and drainage of ischiorectal abscesses, received a total of 300 gr sulfathiazole and 5 cc soluble sodium sulfathiazole Autopsy disclosed extensive focal necrosis of the liver, kidneys spleen heart and adrenal glands, in all probability due to the toxic action of sulfathiazole

These toxic changes may occur even when the sulfathiazole blood levels are within the so called safe margin Urinary suppression should be closely watched

(²) Canad M A J 48 93 January 1943

Sulfonamides in conjunction *with azochloramid* were used by Erwin Neter[9] (Univ of Buffalo) *in treatment of localized infections* No toxic effects were noted, two cases are described

Although Neter's observations do not permit any far reaching conclusions, they suggest that in certain cases of localized infections in which treatment with sulfonamides alone fails to result in cure the combined administration of sulfonamide and chlorine compounds, such as azochloramid, may yield increased antimicrobial effects This confirms similar observations of Goldberger A thorough investigation of the possible toxic effects resulting from this treatment should be carried out It is well to keep in mind that the combined use of sulfonamides and other drugs may decrease the toxicity of the sulfonamide or enhance its ill effects The possible clinical applications of the synergistic action of sulfonamides and chlorine compounds deserve further attention

[The late F C Schmelkes proposed the combination of azochloramid with the sulfonamides in the treatment of localized infections His original experimental work seemed convincing that the addition of azochloramid greatly increases the value of the sulfonamides when applied locally in the treatment of infections —Ed]

W D Sutliff Milton Helpern, Gerard Griffin and Herbert Brown[1] report that *sulfonamide toxicity* was given *as the cause of death in 28 cases in New York City in 1941* These cases conformed to one standard of diagnosis They were reported almost entirely by ordinary methods

Approximately 1 death from sulfonamide toxicity occurred in every 2 571 deaths from all causes One fatal sulfonamide reaction was reported by ordinary means among every 685 estimated pneumonia deaths The highest frequency was found to be 1 sulfonamide death among 161 reported pneumonia deaths, as shown by supplementary inquiries on sulfonamide toxicity to physi

(9) Am J Surg 58 69 October 1942
(1) J A M A 121 30 313 Jan 30 1943

Propamidine —In established wound sepsis, local application of sulfonamides has limited value, mainly because their action is inhibited by the peptones and other constituents of pus and tissue fluids But the bacteriostatic action of the amidines is not inhibited in this way, and therefore W R Thrower and F C O Valentine[5] (London Hosp) made an experimental and clinical study of the action of propamidine (4 4' diamidinodiphenoxypropane dihydrochloride)

In vitro experiments demonstrated that propamidine possesses a bacteriostatic activity against Staphylococcus aureus of the same order as sulfathiazole and a bactericidal activity about equal to its bacteriostatic activity Effective concentrations did not inhibit phagocytosis or cause hemolysis, and the bactericidal effect was not seriously lessened by presence of pus Since in vitro experiments indicated that low concentrations should be used, a watery gel of methyl cellulose of constant viscosity, strength varying between 4 5 and 5 per cent, was selected as a suitable vehicle Optimal concentration to be placed in contact with human tissue, intervals between dressings, length of treatment and further necessary measures were learned by numerous clinical trials

Technic —The technic of the dressing is simple but important At the beginning of treatment the wound is cleaned with normal saline and if necessary explored to insure that the jelly can make contact with the entire surface A sterile spatula is used to fill the cavity to skin level with 0 1 per cent propamidine jelly The jelly must not remain on the skin edges, which should be left dry The wound and surrounding skin are covered with two or three layers of impermeable vaseline gauze to make a good joint Only a thin layer of gauze or wool is needed over the vaseline gauze to allow the bandage to fit snugly, thus considerable economy in dressings is effected When dressing is repeated, exudate and stale jelly are swabbed or washed out with saline and fresh jelly is applied as before Although the preparation is self sterilizing, the stock supply should not be contaminated by introducing into it the spatula used for applying the jelly to the wound

(5) Lancet 1 133 136 Jan 30 1943

for, and any indication of decreased urinary output should be the signal for suspension of the drug Jaundice due to liver damage may occur during sulfathiazole therapy

A R Hodgson and J R Robinson[3] found that the *blood levels of sulfanilamide applied locally* in 41 cases of traumatic and surgical wounds were usually of the order of 1 mg per 100 cc for each gram deposited in the wound In many cases local application alone will maintain an adequate therapeutic blood level, so that simultaneous oral administration of the drug is not always necessary Indeed, with some wounds care is rather needed lest too much sulfanilamide be applied locally and toxic effects result from free absorption

The use of sulfadiazine in the management of simple mastoidectomy wounds was tested by Charles A Tucker and Carlyle G Flake[4] (Boston) in a controlled series of 41 patients divided into three groups A, those receiving sulfadiazine locally the wound being closed without drainage, B, those receiving sulfadiazine by mouth, the wound being closed without drainage, and C, those not receiving sulfadiazine, the wound being drained in the usual fashion

The hospitalization required in groups A and B averaged about 10 days the wounds healing per primam and the tympanic membrane being healed and dry at that time The wound broke down in only one case, in group B There were no untoward results The patients in group C had the usual prolonged convalescence

The authors cannot advocate with impunity any one method for control of wounds in mastoidectomy, although sulfonamide therapy seems to be of definite value Certainly the prime requisite for good results is performance of a standardized thorough, simple mastoidectomy

[This series of cases is of course much too small to be of statistical significance —Ed]

(3) Lancet 2 392 394 Oct 3 1942
(4) New England J Med 227 1014 Dec 31 1942

At a Royal Air Force General Hospital George H Morley and J P Bentley[6] used *propamidine in* seven recent *burns,* usually within five hours of the accident, in five other burns given preliminary treatment elsewhere for from three days upward and in two cases to prepare infected areas for skin grafting

TECHNIC—The preparations used were (1) 0 1 per cent propamidine in a Mumford base (2) 0 1 per cent propamidine in a water soluble jelly base, (3) 0 05 per cent propamidine in the same jelly base (4) a first aid preparation of 0 1 per cent propamidine with 1 per cent amylocaine hydrochloride (stovaine) in the Mumford base

Fresh burns were initially cleaned with saline Dead skin was removed from the surface of blisters and preparation 1 was spread thickly over the burned areas with a spatula A sealing dressing of thick vaseline gauze was applied and held in place with ordinary bandages, left untouched for 48 hours The dressing was changed in a saline bath (this is not essential) Because necrosis of the granulations is apt to occur with a bacteriologic relapse if propamidine dressings are applied for more than 10 days treatment was changed at the end of this time to sulfanilamide and tulle gras dressings

For infected burns, preparation 3 was used because the water soluble jelly enables more intimate mixing of propamidine with the slough and granulation It was sometimes a slightly painful dressing and tended to make the surrounding skin soggy

Propamidine may prove to be an almost ideal first aid preparation A soft cream, the 1 per cent stovaine preparation, is simple to apply and extremely soothing Propamidine treatment relieves both patient and nursing staff for dressings need be changed only at 48 hour intervals and no special or elaborate apparatus is required Progress of the cases was remarkable for the rapidity of separation of slough and speed of epithelialization The latter and mobility of the part throughout treatment produced a minimum of scar tissue and extremely good cosmetic and functional results Where propamidine was tried as an alternative dressing for areas which had become indolent or infected with sulfon

(6) Lancet 1 138 139 Jan 30 1943

About 50 patients with various septic wounds were treated The only disadvantage was the tendency of the jelly to irritate the skin at the edges of the wound

The danger of using too high a concentration of the drug is shown by a case in which a 0.4 per cent preparation soon produced necrosis of granulation tissue Efficacy of the 0.1 per cent preparation appears to make higher concentrations unnecessary and even weaker concentrations may be effective in shallow wounds without much discharge

Full benefit is obtained in 10 days Long application may lead to mild superficial necrosis and to relapse in the bacteriologic picture, but a second course of treatment may be given in a wound which later becomes reinfected A satisfactory result may sometimes be obtained when an interval of a week is left between dressings When dressings are painless and readily performed, it is advisable to repeat them on alternate days, or even daily at first when there is much discharge

Cultures showed that of the various micro-organisms present in the wound the streptococcus first disappeared and then the staphylococcus Proteus vulgaris and Pseudomonas pyocyanea often persisted without appearing to retard progress Where there is infection of bone or a sequestrum, sinuses are likely to persist, although the surrounding tissues may become clean and healthy

Correctly used propamidine can clear the field of dangerous organisms in 10 days but as soon as this has been done the surgeon must apply without delay such measures as may be necessary to promote final closure Sometimes spontaneous healing will take place but often skin grafting or secondary excision will be needed The relative or absolute sterilization of the tissues brought about by propamidine makes the success of such operations probable Where pedicle skin grafting is needed, the graft should be prepared in advance so that it will be ready when required

because of staphylococcic infection Although healing may take place at a normal rate in presence of saprophytic and mild pathogenic organisms, a graft can be destroyed by any pus producing organism which mechanically lifts it from its bed, just as easily as it can be killed by the most virulent streptococcic infection

Further experience seems to indicate that 0 1 per cent propamidine in a Mumford base (lanette wax and paraffin) has a considerable advantage over the water soluble jelly mixture, and other patients are now being treated with it The result in the only fresh burn in the series was impressive

TUMORS

Lipomas —Philip N Hogue[8] (Seattle) states that lipomas may be single or multiple, symmetrical or asymmetrical, subcutaneous, synovial, intermuscular or lying in any of a number of organs Most are benign, but many become malignant Precise origin of adipose tissue is not determined, there is good evidence that it is not merely a connective tissue containing fat, but a special organ, a part of the reticulo endothelial system Lipomas are thought to have the same origin as normal fat tissue

Gross appearance of these tumors is characteristic They exhibit a striking connection with nutrient blood vessels, each of the multiple lobules growing around a branch of the main vessel Lateral anastomoses of the vessels are scanty, so that the tumor grows expansively and is readily shelled out of position Microscopic structure resembles normal fat tissue, but the lobules vary greatly in size and the supporting stroma is irregularly distributed Cells may be overdistended with fat or may produce the smaller type of embryonal fat tissue, often there are areas of polyhedral cells in which fatty deposits are incomplete From such cells lying in isolated

(8) West J Surg 50 332 338 July 1942

amide resistant organisms, the infection yielded quickly and healing was accelerated In two cases in which propamidine was used to clean them up preparatory to skin grafting, it seemed to be successful in controlling streptococcic infection, but failure to control Bacillus proteus and Pseudomonas pyocyanea resulted in complete failure of one sheet razor graft, although in an other case 100 per cent success was obtained with pinch grafting Propamidine seems to be of value in early separation of tight sloughs in deep burns by virtue of its apparent property of controlling streptococcic and staphylococcic infection while allowing saprophytic and proteolytic organisms to flourish These organisms must be controlled by other measures before a surface can be considered adequately prepared for skin grafting

At the Queen Victoria Plastic and Jaw Injury Center, East Grinstead, A H McIndoe and A. R Tilley[7] have used 0 1 per cent *propamidine* in a water soluble jelly base in 11 cases of persistent beta hemolytic *streptococcic infection* in which other methods had failed The infection was successfully controlled in 4 to 10 days In some instances, clinical improvement in the wounds was striking in 48 hours this appeared to be in the more recently infected ones, older, more indolent surfaces responded less rapidly But steady improvement occurred in all cases coincidently with disappearance of the beta hemolytic streptococcus However, reinfection was noted several times requiring a second course

The authors had been warned that if propamidine was applied longer than 10 days irritation of the surrounding skin and necrosis of the granulations might be expected This was not seen though there was mild irritation of the skin in one case in which the 10 day period was exceeded While it is clear that the beta hemolytic streptococcus was effectively controlled in this series no such certainty exists regarding other organisms In three cases, subsequent grafts failed partially

(7) Lancet 1 136 138 Jan 30 1943

Cardiac lipomas have been described by many authors. Lipomas of the uterus are rare, only 46 cases having been reported.

Both solitary and multiple lipomas tend to be associated with melanomas of the skin. Multiple lipomas (Fig. 37) seem to have a definite hereditary influence. Many think they have a connection with peripheral nerves. Neurofibromas are rare with lipomas. Nerve fibers



Fig 35 (left) —Lipoma of left thigh
Fig 36 (right) —Lipoma of right shoulder

have been traced into many lipomas. There are many similarities between multiple lipomas and neurofibromas, but no definite histologic evidence proves relationship. However the two conditions must be differentiated.

There are many multiple lipomatous lesions in more diffuse form and less definitely neoplastic. These are associated with endocrine disturbances. The commonest syndromes are Dercum's disease (adiposis dolorosa) and Frohlich's (dystrophia adiposogenitalis). In addition the "fat neck" of Madelung must be mentioned. This is characterized by symmetry, diffuseness and local

foci or along the vessels lipomas chiefly develop Blood vessels are usually overabundant and many cellular arterioles are found in the stroma running out into the lobules and dividing into capillaries Extensive over growth of blood vessels leads to formation of vascular fatty tumors, lipoma telangiectaticum or cavernosum, so that it is sometimes difficult to distinguish between vascular lipoma and angioma Lymph vessels also may be overdeveloped, and Borst observed transformation of a lipoma into a fibrous lymphangioma

Geschickter s classification is useful

LIPOMATOUS TUMORS (NEOPLASMS OF FATTY TISSUE)

1 Benign lipomas
   a) Solitary
   b) Multiple
2 Recurrent lipomas
   a) Fibro (myxo-) lipoma
   b) Embryonic (xantho) lipoma
3 Liposarcomas
   a) Secondary to benign lipoma
   b) Primarily malignant

Benign lipoma usually occurs in adults between 30 and 50 and in females more often than males The sub cutaneous lipoma (Figs 35 and 36) is commonest Li pomatous processes may involve the joints orbits larynx base of the tongue cranial cavity, renal, peri renal and other types of tissue

Lipomas of the gastro intestinal tract are subserous and submucous They may occur in the gastric sub-mucosa but the most frequent sites are cecum, ascending colon and sigmoid flexure Symptoms are those of in testinal obstruction partial or complete Average age incidence is 40 60 Since they are usually considered malignant until actually sectioned treatment is radical

The literature records 34 cases of thoracic lipomas There are no pathognomonic signs or symptoms, but the commonest are dyspnea palpable tumor, pain positive roentgen shadow cyanosis and cough in that order They are most often mistaken for collections of fluid

may undergo degenerative changes from strangulation of the pedicle Embryonic or xantholipomas show embryonic fat cells with characteristic foamy cytoplasm like immature fat deposits in late embryonic life In Geschickter's series were 18 cases of fibrous or embryonic lipomas Nine had one or more recurrences and



Fig 38 —Myxoliposarcoma of foot of woman 47

four of the recurrent growths later underwent malignant change

In the King County Hospital Seattle in 159 cases of lipoma used in the author s study, there was one fibrolipoma in a woman 57 It weighed 500 Gm and was found in the upper pole of the left kidney

Ewing states that liposarcomas occur frequently and have high mortality Wide divergence in structure of the various types of liposarcoma has often prevented their recognition and resulted in inadequate reports

ization of the fatty tumors to the neck, but they may *not all arise at the same time Usually there are fatty* deposits in other parts of the body After removal, the tumors do not recur, although there may be new formations about the periphery Chief occurrence is in men, especially alcoholics Lipodystrophia progressiva is characterized by loss of fat in the upper part of the body almost to emaciation, while fat is abundant and often excessive below the waistline After short period of pro*gression, it remains stationary It occurs chiefly in* females in a ratio of 2 1 There is supposed to be some relation to the thyroid



F 37 —Multiple lipomatosis

Myxomatous lipomas show numerous early fibroblasts with hyperchromatic nuclei in a myxomatous like stroma This group includes pedunculated lipomas which

may undergo degenerative changes from strangulation of the pedicle Embryonic or xantholipomas show embryonic fat cells with characteristic foamy cytoplasm like immature fat deposits in late embryonic life In Geschickter's series were 18 cases of fibrous or embryonic lipomas Nine had one or more recurrences and



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They occur anywhere a lipoma may be found but most frequently in intermuscular, perineal, periarticular and mediastinal regions

At King County Hospital, only one case of definite myxoliposarcoma (Fig 38) has been seen in the last 10 years This was in a woman 47, who had had gangrene of the right foot and loss of two toes at age 14 following typhoid fever A chronic ulcer on the heel had been spreading for two months prior to admission when metastatic nodules were found in the groin She received deep roentgen therapy finally a palliative leg amputation was performed She died soon thereafter

Carcinoma—Mather Cleveland and Leila Charlton Knox[1] (New York City) report a case of *bilateral carcinoma of the adrenal cortex with metastasis to the right iliac bone* The patient showed no sexual abnormalities such as have sometimes been reported in other patients with similar lesions The tumor was recognized as a malignant growth involving the ilium The cause of the patient's complete collapse after an extremely simple operative procedure was unrecognized before death although he presented the classic signs of insufficiency of the adrenal cortex Fortunately this clinical failure could not have affected the eventual outcome

Carcinoma of the adrenal cortex is rare instances of simultaneous involvement of both adrenals are still rarer and metastases of such tumors to bone have been reported infrequently Of 49 cases from the literature 18 occurred in men 23 in women and 8 in children under 14 Of the 23 women 12 were in the fourth decade Six of the 17 men whose age was given were in the fifth decade In five cases the tumors were bilateral and in four of these the growths may have been secondary In the 40 cases in which the site of origin was reasonably sure 14 tumors were primary on the right side and 26 on the left

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(1) Arch Surg 47 1[illegible] 0 [illegible] 1943

The symptoms are extremely variable, since the specific biologic effects of abnormal hormones may or may not be present. Fewer symptoms are usually present if the patient is a male: 10 of the 18 men showed no sexual abnormalities while only 3 of 23 women were without structural sexual alterations. Before puberty, such changes may be absent.

In women the syndrome closely resembles that of Cushing's pituitary basophilism in that there is a diminution of the female characteristics associated with appearance of certain male characteristics. Amenorrhea, obesity or loss of weight and changes in the skin (usually acne form coarsing and increase in the oily secretion), accompanied with hypertrichosis and striae are frequent. Polycythemia with dusky red or cyanotic face or extremities, hypertension and headache are often present. Masculinization is shown by hypertrophy of the clitoris and masculine growth and distribution of hair on the face, trunk and extremities. In some cases extreme changes have taken place in the general habitus. In the male the syndrome is usually less well defined than in the female. Simpson and Joll discussed six cases in which female characteristics were noted: hypertrophy of the breasts was the first symptom in four and was associated with atrophy of the testes, loss of libido and gain in weight in three.

With continued growth of the tumors remarkable skeletal changes may occur. Osteoporosis, especially in the bones of the skull and trunk, is rather frequent, but overgrowth of these bones may also take place. Extreme deformities due to fractures and compression of the vertebral bodies may be associated with only slight involvement of the long bones of the extremities. The involved bones show no extensive fibrosis or accumulation of granulation tissue such as occurs with osteitis fibrosa cystica, but there is extensive irregular atrophy of all bony trabeculae and of the cortex, with at times some minute cysts and dense osteoid tissue. The condition of the bone

marrow varies Sometimes it is found to be largely fatty and at others shows erythropoietic hyperplasia

Despite the general decalcification and multiple fractures the calcium content of the blood may be little altered Frank found excessive amounts of estrogenic substance in the urine while Cahill did not find large amounts in his patients, but much work remains to be done in this field

In diagnosis, exclusion of pituitary disease with or without tumor offers the greatest difficulty The prognosis is obviously poor since the tumors metastasize readily by the blood stream and grow rapidly duration of life without operation is short Operation, though the mortality rate is high has been successful in several cases

Of 40 patients who underwent operation about 50 per cent died shortly and Lukens stated that most fatalities occur within the first 48 hours Walters and *Kepler* believe that when active well directed postoperative treatment with adrenal cortical extract, sodium chloride sodium citrate and sodium bicarbonate and a low potassium diet is carried out the surgical risk is not too great The outstanding symptoms of adrenal insufficiency appear within eight hours after operation and include rapid pulse fall in blood pressure drowsiness hiccups nausea and vomiting Insomnia anorexia weakness apathy and restlessness may follow

Metastases seem to be most frequent in the lungs liver *and lymph nodes The adrenal veins and the vena cava* have been found involved Less frequent are metastases *to the brain kidney heart* peritoneum and pancreas In contrast to the hypernephromas of the kidney which readily metastasize to bone carcinomas of the adrenal have only infrequently been found to do so In one other case that of Kimm and Wu metastases were present in the iliac bone vertebrae ribs and scapula When roentgenograms are studied it should be noted that the frequency of widespread decalcification and crushing is greater than that of skeletal metastases

Cylindroma (Adenocarcinoma of Cylindroma Type) —In a review of primary tumors of the submaxillary gland, Malcolm B Dockerty and Charles W Mayo (Mayo Clinic) called attention to the frequent incidence of cylindroma Throughout the literature and in many of the older cases of their own series this neoplasm was frequently confused with mixed tumors In their series these cylindromas were associated with an extremely high incidence of recurrence, even after radical operation Infiltrative tendencies were most pronounced with special reference to perineural lymphatic involvement Metastasis was not infrequent, and the prognosis in general proved unfavorable not only when the neoplasm was a pure cylindroma but also in the small group of cases showing transition to the mixed tumor type

The authors report two additional cases of cylindroma In one, the tumor originated in the tongue, in the other the primary site could not be ascertained with certainty but the parotid gland appeared to be the probable source

Cylindroma is most frequently encountered in the parotid gland where according to Stein and Geschickter incidence is 17 4 per cent of the tumors arising there The submaxillary gland follows with approximately the same relative incidence, but with a much smaller total number of neoplasms arising in this location However cylindromas can arise in connection with the lips gums tongue floor and roof of the mouth, pharynx larynx and even the lacrimal gland Briefly they can occur wherever mucous glands are found about the head and neck The aforementioned locations are, in the same order of frequency, the favorable locations for the so called mixed tumors These characteristics together with the fact that adenocarcinoma of the mixed tumor type is 5 10 times more commonly encountered than adenocarcinoma of the cylindroma type, have combined to mask the distinction between these two forms of malignancy The occasional discovery of neoplasms having features

(*) Surgery 13 416 422 March 1943

of both types has merely added to the difficulty However, whenever a mixed tumor has exhibited cylindromatous areas microscopically, prognosis has appeared to be almost as serious as it would be if the neoplasm existed as a pure cylindroma

The relatively long clinical history in each of the two reported cases is in keeping with the findings in similar lesions of the submaxillary gland It adds further to the difficulty of preoperative separation of the tumor from some of the more rapidly growing examples of mixed tumor The persistent pain suffered by both patients recalls the frequency of pain (70 per cent) noted in the series of submaxillary tumors Finally, in both patients metastasis developed while the primary lesion seemingly was being controlled by local treatment This observation emphasizes further the importance of early recognition of cylindromas and the necessity for a reserved, if not a guardedly bad prognosis

A clinical analysis of 30 cases of *multiple carcinoma* made by Hugo Hellendall[1] (Columbia Univ) showed that the period from the first appearance of symptoms until death was shorter in cases of multiple primary malignant growths than in single ones, the weight loss was also considerably greater The correct diagnosis of multiple cancers was made during life in four of the synchronous and in five of the metachronous cases This shows clearly the value of radioscopy in the diagnosis of cancer X ray examinations of the total digestive tract should be made because of the high percentage of multiple cancers in different segments of the tract

The influence of multiple cancers on the blood as well as the value of the phosphatase reactions in multiple cancers should be investigated further

The view expressed by Boyd that the presence of one malignant tumor usually confers an immunity which prevents another from developing and that the carcinomatous changes in multiple polyps of the intestine

(1) Am J Surg 60 935 April 194

occur only in one papilloma is not borne out by this material In four cases of polyposis there were multiple cancers of the large intestine in one case there were three primary growths and in another five

Of 13 clinically observed patients with multiple cancers 5 are living and 8 are dead Among the living patients there were two with synchronous and three with metachronous cases The two with synchronous cases were still in good health 2½ and 3¼ years after operation The three with metachronous cases have not reached the five year limit either There is good reason, however, to believe that all five patients will be absolutely cured Therefore it can be concluded that the prognosis in cases of multiple cancer is not altogether hopeless

Melanoma—William H Bickel Henry W Meyerding and Albert C Broders[4] review the 107 cases of *melano epithelioma (melanosarcoma melanocarcinoma malignant melanoma) of the extremities* seen at Mayo Clinic during 24 years

If treatment had not been instituted the patients would have died, whereas 29 8 per cent of those who were treated by excision survived five years or more after treatment was instituted This group included many cases in which the lesions were small and the patients were seen during the early stages of the disease

In cases in which the lesion was more extensive and of long duration amputation was the commonest type of treatment, yet in this group there was a five year survival rate of 21 1 per cent after treatment was instituted

None of the patients in whom irradiation was the only form of treatment survived three years from the time treatment was instituted Irradiation was used in conjunction with operation in numerous cases when the patient refused an operation and when the lesion was inoperable This treatment should not be condemned, as further advancement in the science of radiology and its

(4) Surg Gynec & Obst 76 570 576 May 1943

clinical application may yet prove it to be beneficial

Melano epitheliomas may be present for long periods before their seriousness is determined or recognized and their condition may be activated by meddlesome treat ment Therefore, treatment of choice is wide excision with removal of regional lymph nodes or amputation When tumors do not appear to be increasing in size or showing evidence of ulceration, wide local incision seems adequate

Joseph A Lazarus and Morris S Marks[2] (New York City) report two cases of *synovial sarcoma,* one involv ing the palm of the hand and the other the knee joint

This is a highly malignant tumor arising from syno vial membranes of joints bursae and tendon sheaths The paucity of cases is more apparent than real because of the many designations under which they have been recorded, owing to the variation in histologic architec ture of the tumors Although some tumors are firm and tough, the majority are soft and myxomatous A characteristic feature is the presence of clefts lined by strands of polyhedral or cuboidal cells resembling pave ment epithelium Areas composed of closely packed, flat or spindle shaped cells are often interspersed among these strands of cuboidal cells Large xanthoma cells are occasionally seen and may lead to the erroneous diagnosis of benign giant cell xanthoma According to Knox, one of the characteristic features of this type of tumor is the presence of swollen cells which result from mucoid degeneration, although mucus has never been found in these tumors

Seventy six cases are reviewed, including the two re ported by the authors Nineteen of the patients gave a history of trauma Forty six were between the ages of 20 and 40 Pain was present in 52 6 per cent, but when the tumor involved the knee joint it was a prom inent symptom A tumor was noted in 93 4 per cent

(2) Surgery 1 90 308 February 1943

and was present for an average of 30 months The aver age duration of symptoms was 36 months The knee joint was involved in 48 7 per cent of the patients, the elbow in 10 5 per cent, the ankle in 9 2 per cent and the palm of the hand in 4 per cent

Prognosis is poor The least malignant tumors are supposedly those containing a great number of multi nucleated cells, while those characterized by closely ap proximated cells presenting oval or round nuclei dis play the highest degree of malignancy Tumors present ing well defined clefts and cells resembling most the characters of synovial cells are moderately malignant

In 56 6 per cent of patients prompt recurrence and metastases followed treatment According to Knox, the interval between time of onset of symptoms and time of the terminal illness varies between 7 months and 7½ years Follow up studies on part of the series revealed 10 patients to be living five years or more after onset, while 9 were alive between three and five years, 8 suc cumbed between the first and the third year and 15 within the first year, 21 were reported well without fur ther comment

Local wide excision is advocated for encapsulated and accessible tumors Radical amputation is reserved for tumors showing, on histologic examination, a high grade of malignancy, or when local recurrence follows extir pation and also for inaccessible tumors Irradiation is advocated only as an adjuvant to surgical intervention

BLOOD VESSELS

Aneurysm of the temporal artery is a rare condition usually post traumatic Roswell K Brown and Robert H Mehnert[3] (Lackawanna N Y) describe a case of spontaneous true aneurysm which is apparently the tenth of its kind to be reported

(3) Surgery 1 711 1 November 194?

Man, 34, about five years before admission, noted a small swelling in front of the right ear. Its size increased with gradual acceleration, one year before it was only about one half its present size. He had no pain or other symptoms and no history of injury or illness for 10 years. The tumor measured 5.7×3×2.5 cm and was undoubtedly an aneurysm of the temporal artery. After preliminary ligation of the external carotid the tumor was easily removed.

Incisions were placed to give adequate exposure and leave no noticeable scars. While the neck operation with ligation

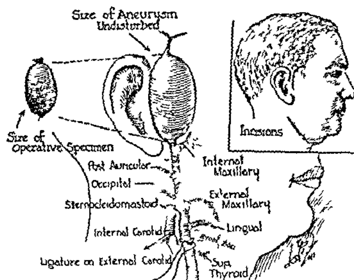


Fig 39—Sketch to show vessels seen at operation

of the external carotid might seem unnecessary, rapid filling of the aneurysm after compression and proximity of the facial nerve led to this precaution. Ligation distal to the origin of the lingual artery probably would have reduced the blood flow into the sac more effectively. Extreme elasticity of the thin walled aneurysm was striking. The volume of the specimen as it was removed was apparently only about one third that before operation (Fig 39). The sac was immediately surrounded by loose connective tissue.

Harold Dodd[4] (Ilford) recommends certain *instruments for the aneurysm needle technic* of ligating blood vessels before dividing them rather than the con

(4) Brit M J 100 July 194

ventional "clip, cut and tie" especially in gastric resections, nephrectomies, ligation of the cystic duct, appendicular mesentery, thyroid vessels and for ligation and injection of varicose veins

INSTRUMENTS—The dissector director (Fig 40) is of good length, round pointed, deeply grooved and slightly curved at the tip Its generous channeling enables the aneurysm needle to pass easily under the tissues without engaging in something below or at the sides and particularly permits the blade of the scissors to slide underneath for easy cutting

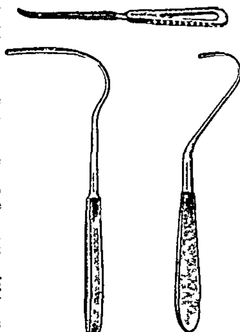


Fig 40 (top)
Fig 41 (left)
Fig 42 (right)

The aneurysm needle (Fig 41) is characterized by a long beak which enables it to carry a ligature round inaccessible pedicles like the coronary or renal artery, then to bring it back close to the surface of the wound The delicate aneurysm needle (Fig 42) is light and fine in shaft and tip It is used for passing behind delicate leashes of vessels behind the duodenum The seeking forceps (Fig 43) is valuable for defining the delicate vessels behind the duodenum and around the thyroid

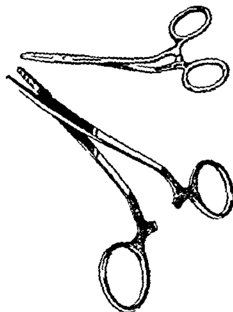
The light needle holder (Fig 44) is suitable for the dainty suturing required in plastic operations on the skin, kidney pelvis in children, common bile duct and nerve and tendon suture It has sure grip of the finest needles, and is dependable though light

Treatment of Acute Arterial Occlusion by Intermittent Venous Occlusion—Robert R Linton[5] (Boston) reports the case of a woman, 58 with the arterial blood supply of the left leg interrupted by ligation of the

(5) Arch Surg 46 395 403 March 1943

hypogastric artery and occlusion of the external iliac artery secondary to surgical trauma Intermittent venous occlusion re established adequate arterial circulation and prevented gangrene

TECHNIC —The pneumatic tourniquet was applied as high as possible on the thigh and the leg elevated to the level of the heart Pressure in the tourniquet was maintained at 50 mm Hg The cycle used for the first 48 hours was 9 minutes of occlusion followed by 1 minute of release The long period of occlusion in relation to the short period of release is important in proper use of intermittent venous occlusion Thus in this case, after inflating the tourniquet it was possible to see gradual return of color to the extremity from above down Nine minutes was required for it to reach the ends of the toes, and as soon as pressure was released the leg foot and toes blanched quickly As collateral circulation gradually improved it was possible to change the cycle to one of four minutes of occlusion with two minutes of release


Fig 43 (top)
Fig 44 (bottom) (Dodd p 168)

Treatment should be commenced as soon as possible after occurrence of the arterial occlusion If eight hours or longer elapses, intravascular thrombosis may occur in the distal part of the extremity and preclude any chance to save the limb The extremity should be at heart level so that when the pressure is released blood and lymph will drain from the limb Shock position, if necessary for general treatment, is no contraindication to intermittent venous occlusion but allowance must be made in the timing of the cycle, since in this position blood will enter the extremity more slowly and drain out of it more rapidly If necessary to keep the head much higher than the extremities as in a patient with cardiac disease

intermittent venous occlusion should not be used, because the resulting venous and lymphatic stasis will produce edema and interfere with capillary circulation The pneumatic tourniquet should be placed as far proximal on the extremity as possible to include as much as possible of the collateral circulation

It is necessary to keep a difference of at least 50 mm Hg between systolic blood pressure and pressure in the tourniquet The cycle should be determined for each case and checked each day

In severe arterial occlusion, continuous treatment day and night is recommended until the circulation im

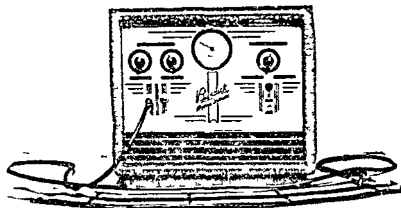


Fig 45

proves sufficiently to permit rest periods of one to two hours between periods of three to four hours of treatment In the case reported an ordinary sphygmomanometer was used for the tourniquet since the automatic type of electrically controlled machine did not permit a nine minute "on" and one minute "off" cycle The cuff of the instrument was inflated and deflated manually every 10 minutes for the first 48 hours by the nurses It is now possible to get any cycle with an "on" period of 1 to 10 minutes and an "off" period of 1 to 6 minutes with the Burdick automatic electric machine for producing intermittent venous congestion (Fig 45)

William B Swartley, S Dana Weeder and Edward

Francis McLaughlin[6] (Philadelphia) treated a patient with *polycythemia vera, with thrombosis* in the vessels of the right arm accompanied by massive swelling extending to the chest wall and neck. Seven other such cases have been traced in the literature, but this is the only one in which the process resulted in gangrene. With Lohr, the authors believe that unrecognized polycythemia vera may underlie certain cases of so called effort thrombosis.

Thrombosis of vessels in the lower arm, forearm or wrist and the extensive lymphatic stasis which follows may explain many cases incorrectly designated examples of subclavian or axillary thrombosis. In a patient with thrombosis, increased red cell and hemoglobin values call for therapeutic blood letting regardless of whether the condition can be accurately diagnosed as true polycythemia or not.

Since the question of compensation may arise in cases of "effort thrombosis" it is well to establish presence or absence of polycythemia vera in such cases.

Hemostasis.—R. T. Tidrick, W. H. Seegers and E. D. Warner[6a] (State Univ. of Iowa) report that *experience with thrombin topical as a hemostatic agent* in a wide variety of cases indicates that it is a useful adjunct to surgical technic. In general oozing of blood from capillaries and small venules can be checked promptly whenever the bleeding surfaces are accessible. Even in the case of small arteries application of thrombin is often effective, particularly if digital pressure can be applied to the bleeding points momentarily to permit the clot to become firmly anchored in the tissue.

There has been no evidence that the thrombin produced local irritation nor that patients in whom the preparation was used repeatedly became hypersensitive to it. No patient showed untoward effects from absorption of the thrombin or from local thrombosis of vessels.

(6) Ann. Surg. 116: 184-193, August 1942.
(6a) Surgery 14: 191-196, Aug. 1943.

Judah Ebin[7] (Columbia Univ) developed a new *carbon dioxide electrocautery technic to occlude large veins*

TECHNIC—A block of dry ice applied to a segment of vein with moderate pressure empties and freezes the channel and its lateral tributaries for a short distance before they enter the vessel A larger strip is frozen than is to be coagulated e g, 6 cm is frozen and the middle 3 cm coagulated After one minute the refrigerant is removed and the electrocautery applied The frozen extremities and tributaries of the vessel are watched, if blood enters them, electrocoagulation is stopped and the procedure repeated After one segment has been occluded, the portion proximal to it is even more easily emptied by freezing with moderate pressure, as the main source of supply has been cut off and blood is being moved in the direction of flow While more difficulty may be encountered in emptying strips distal to the coagulated segment, because blood is being moved against the venous current, it is almost always accomplished in the usual manner Allowing the refrigerant to overlap slightly on the occluded strip is helpful

If cauterization is carried too far or continued despite blood in the lumen, the vessel may tear In that event the strip is refrozen and the area about the tear coagulated The widest vessel occluded by this technic was the inferior vena cava of a dog 13 mm in diameter A vein of any extent may be obliterated by freezing and coagulating consecutive strips The resulting closure is permanent Application of this technic in treatment of venous angioma of the brain is suggested

Judah Ebin[8] extended his experiments with *solid carbon dioxide to stop bleeding in brain, viscera and superior sagittal sinus* of cats

TECHNIC—The bleeding area is first frozen by a one minute application of solid carbon dioxide and then treated with the chemical coagulant Of various coagulants tested, a 20 per cent solution of ferric chloride was most effective This chemical combines with proteins principally those of the plasma (albumin, globulin and fibrinogen), to form ferric proteinate, a black coagulum which occludes the mouths of torn vessels Since the refrigerant must come in contact with all bleeding points the solid carbon dioxide must about fit the bleed

(7) Surg Gynec & Obst 6 43 50 January 1943
(8) Arch Surg 46 386 394 March 1943

ing area Various sizes and shapes are prepared before operation and kept in a vacuum jar until needed, a small sterile knife is kept on the instrument table to make minor changes in shape as required An Allis clamp or a large curved clamp with close fitting rubber tubing on the prongs is used to handle the refrigerant

Ferric chloride is obtained in crystalline form A 20 per cent solution in distilled water is made up and passed through filter paper It has a pH of 1 and is therefore bacteriologically sterile The solution is best applied with pellets of absorbent cotton left in place for one minute and the excess solution then removed by suction

This procedure may be effective in similar situations in man and in war surgery

Stanley Alstead[7] studied the *rate of blood regeneration after hemorrhage* in 48 male subjects in whom venesections were carried out Ages were 27 92, but most of the patients were in the later decades, averaging 60 3 Their complaints were of no significance in relation to blood regeneration They received the ordinary ward diet and it was estimated that the average iron content of the food was 12 6 mg daily The volume of blood withdrawn varied from 350 to 1 300 cc average being 710 cc Rate of blood regeneration was determined by periodic estimations of the hemoglobin

After five weeks half the patients were still anemic and even after 15 weeks recovery was incomplete in 10 per cent The volume of blood lost did not appear to determine the persistence of the anemia but there was some evidence that the duration of the anemia was proportional to the initial fall in hemoglobin It is suggested that the probable cause of the persistence of a low hemoglobin in some of the patients was overdilution of the blood by transference of excessive quantities of fluid from the tissue spaces

In a study to determine the *ceiling of utilization of nitrogen* Robert Elman Ray Charnas and Harriet W Davey[8] (Washington Univ) found that positive nitro

(7) Lancet 1 4 4 4 6 April 3 1943
(8) Arch Surg 47 216 2 0 August 1943

gen balance and regeneration of serum albumin occurred in protein-depleted dogs when 1.75 Gm. nitrogen per Kg. body weight per day was given for two days by continuous venoclysis, an enzymic hydrolysate of casein containing a mixture of amino acids and polypeptides being used as the sole source of nitrogen. When this same total dose of nitrogen was given in 24 hours, there was evidence of much less complete utilization.

Hypertension.—Sympathectomy with section of the splanchnic nerves is *an effective therapeutic adjunct in* some cases of *hypertension*, but there is no agreement concerning the type of operation to be used. Peet advocates bilateral supradiaphragmatic resection of the tenth, eleventh and twelfth thoracic ganglions and the intervening chain, together with the splanchnic nerves; Adson and co-workers prefer subdiaphragmatic removal of the splanchnic nerve and the first and second lumbar sympathetic ganglions, while Smithwick recommends a combination of the two procedures. Whatever method is used, the effect on the blood pressure is often disappointing. It is obvious that surgical treatment of hypertension would be on a firmer basis if there were a more reliable method for identifying preoperatively those patients in whom good results will be obtained.

Therefore, Henry G. Schwartz and Thomas Findley[9] (Washington Univ.) report three cases in which striking symptomatic relief was obtained with *paravertebral injection of the sympathetic system*. They used alcoholic block because the effects of novocain injection alone would have been too transitory to allow adequate evaluation of any response.

The technic followed was similar to that described by White for injection of the upper thoracic trunk in the treatment of angina pectoris, but modified to involve roughly the tenth, eleventh and twelfth thoracic segments, first lumbar segment and the splanchnic nerves.

(9) Surgery 14: 67-71, August 1943.

TECHNIC—Under light morphine scopolamine analgesia, spinal needles were inserted at the appropriate levels, first on the right side about three fingerbreadths lateral to the midline, they were passed just below the lower borders of the trans verse processes or articulating portions of the ribs and then directed medially at an angle of 20 to 30 degrees to a depth of 3 to 3 5 cm beyond the level of the rib articulations At this depth, the needle point comes to rest against the antero lateral surface of the vertebral bodies where the gangliated chain lies As to the splanchnic nerves themselves, their point of entry between the medial and the intermediate crura of the diaphragm lies close to the vertebral body Customary pre cautions were taken to make sure that the needle tips did not lie within the pleural space, blood vessels or intervertebral foramens Injection of 2 cc of 1 per cent solution of procaine hydrochloride at each level was followed by slow instillation of 3 to 4 cc of 80 per cent alcohol Injection was done in both sides at a single sitting In two cases, the solution was also injected into the second lumbar segment on the right side and probably should be done bilaterally Completeness of injection was then determined by a sweat test, cobalt chloride being used as indicator

The authors thoroughly agree with those who prefer operation to injection on the grounds of safety and cer tainty If there were reliable means for predicting post operative results, injection methods could have no de fense However patients who are asked to undergo operation should be selected with all possible care In case of doubt concerning probable benefit from surgery, preliminary paravertebral alcohol injection may be of considerable prognostic value

The role of surgery in management of patients with high blood pressure is considered by Thomas Findley[9] (New Orleans) Hypertension is a symptom not a disease Probably 40 50 pathologic processes have been described as causative agents Some function through neurogenic mechanisms some through the hormonal sys tem, others appear to be primarily renal, and many oth ers are unknown Whatever the cause, all result in arteriolar constriction Recent investigations suggest that

(9) Tri State M J 15 99 50 October 194?

increased resistance may be predominant in the splanchnic area rather than generalized, as formerly believed There is no proof that clinical hypertension depends necessarily on renal ischemia However, strongly pressor substances can be extracted from mammalian kidney tissue and some patients with clinical hypertension have been permanently cured or strikingly relieved by removal of a diseased kidney Many patients with hypertension have unilateral kidney disease, and temptation to advise nephrectomy is strong, but in adults the operation usually fails to influence blood pressure Chronic hypertension apparently is characterized by bilateral kidney disease and removal of one kidney, no matter how badly diseased, cannot be expected to ameliorate long standing hypertension Tempo of the disease is highly variable but it seems imprudent to advise operation if high blood pressure has existed more than two years Chronic atrophic pyelonephritis is the commonest lesion to respond with good results

There are several unique varieties of endocrine hypertension In the type characterized by violently fluctuating blood pressure, presumptive diagnosis should always be tumor of the chromaffin system and search made for adrenalin secreting tumor tissue The commonest site is the adrenal medulla, but it may lie anywhere along the aorta so that localization is impossible These cases are rare, but treatment is gratifying A second type, depending on tumor or hyperplasia of the adrenal cortex, is but one aspect of the adrenogenital syndrome The clinical picture depends on age and sex In many cases no cortical adenoma will be found The glands may be diffusely enlarged, but subtotal resection is hazardous and should not be attempted The surgeon should be prepared to section the splanchnic nerves and excise the upper lumbar sympathetic ganglions

Results of medical management of hypertension of unknown etiology have been discouraging Interest is currently centered on the sulfocyanates No statistics

suggest that they or any other drugs prolong life in hypertensive patients Opposed to dismal results of drug therapy are enthusiastic reports of surgical success The lumbodorsal splanchnicectomy devised by Smithwick appears to give better results than any other technic because it affords more complete denervation of the splanchnic bed and lower extremities It was devised only recently so that comparison with results obtained by the Peet and Adson procedures cannot be made Tentative opinions are that it is the operation of choice

The great difficulty lies in proper selection of patients Experience has disclosed certain contraindications Most surgeons will refuse to operate on anyone over 50 or who has renal or cardiac failure The patient with fixed hypertension and few symptoms is a poor candidate Those with malignant hypertension fare badly unless kidney function is preserved Best results are obtained in young subjects with wide spontaneous fluctuations of blood pressure Operation should be done early, but it is almost impossible to persuade patients to submit to it until they have passed the stage where maximal benefit will accrue Sympathectomy is not the answer to essential hypertension but is the only treatment which has produced apparent cures and prolonged life expectancy Although it may fail to reduce pressure, it will almost certainly afford relief in a high percentage of cases It entails almost no operative mortality It should be done early or not at all

Transfusion—R Arnold Griswold and Alvin B Ortner[1] (Univ of Louisville) recommend *autotransfusion in surgery of the serous cavities* and report 100 cases Hemorrhage was due to ruptured ectopic pregnancy in 22, and penetrating and nonpenetrating trauma to the thorax and abdomen was the etiologic agent in 78 The mortality was 30 per cent All deaths occurred in the traumatic cases giving this group a mortality of 38 4 per cent Grouping the traumatic cases according to

(1) Surg Gynec & Obst 7 16 1 August 1943

type and location of the trauma shows that in 19 penetrating wounds of the thorax there were 6 deaths, mortality of 31.5 per cent, in 21 cases of nonpenetrating wounds of the abdomen there were 5 deaths a mortality of 23.8 per cent, in 38 penetrating abdominal wounds there were 19 deaths, a mortality of 50 per cent The highest mortality, 68 per cent occurred in abdominal wounds with hollow viscus perforation—of 25 cases, 17 ended fatally In all but one of these, injury was due to gunshot wounds, and hemorrhage was greater in this group than in the others

One fatal reaction occurred, owing to a break in the technic of filtering the blood In two other instances there were reactions from which the patient recovered, giving a combined percentage of 3 for reactions There was a doubtful reaction in one case but it could not be definitely established that this was due to the reinfused blood In one case, the patient had no reaction from the autogenous blood but had severe reactions on two occasions from blood obtained from the bank

Some danger accompanies the use of autogenous blood especially of contaminated blood Sterile compatible blood from a donor source is safer, but it must be used in sufficient quantities without delay and it must be remembered that 500 cc is the donor's dose and not the recipient's Use of autogenous blood even though it is contaminated is safer than allowing the blood volume to remain depleted

Hemorrhage is the greatest single factor in the mortality of wounds of the serous cavities Autotransfusion is a valuable adjunct in the treatment of internal hemorrhage With armies in the field and trauma on the increase due to high velocity vehicles both in military and civilian life, this procedure should be held in a foremost place in the minds of those doing emergency surgery

A simple suction apparatus is more efficient in the collection of blood than mopping it from body cavities

APPARATUS —The unit consists of a 500 cc graduated flask

fitted with a rubber two hole stopper and glass connecting tubes Before operation, 50 cc of 2 per cent sodium citrate solution is placed in the flask One tube is attached to the suction and the other to the Pool suction tip When in use, the flask acts as a trap, collecting the blood Two flasks are kept sterile so that as soon as one becomes filled the other may be put in its place After the blood is collected, it is filtered through 10 thicknesses of gauze into a graduated cup and then refiltered into an intravenous set from which the patient is receiving 0 85 per cent saline solution By using the two flasks interchangeably, a large quantity of blood may be collected and returned to the patient without delay

The technic, particularly as regards filtration, must be rigid

Bile mixed with blood due to injury of the liver or biliary tree, and bacterial contamination due to hollow viscus perforation, add danger to the procedure, however, this danger is not so great as might be thought and the need of blood is frequently far greater than the danger involved Old blood because of hemolytic changes, should not be used Alkalinization of the urine may prevent reactions caused by partial hemolysis of the blood

Rudolf Bucher[1] states that the *direct compatibility test before blood transfusion* comes into its own when test serums are not available The test can be carried out in two ways

In one method 10 drops of the donee s blood are allowed to coagulate, then 1 drop of the serum is mixed with 1 drop of the donor s blood to test agglutination Since 20 30 minutes are required to obtain the serum, this method is impracticable in urgent cases

The second method is recommended for these emergencies Two drops of isotonic 3 8 per cent sodium citrate solution are deposited on each half of a glass slide the 2 drops on the left half are mixed with 1 drop of the donee s blood of the same size and those on the right half with 1 drop of the donor s blood Then 1 drop of the donor mixture is transferred to the donee

(1) Schweiz med W hn chr 903 Aug 15 194

mixture, and the latter is observed for agglutination under a magnification of 16 to 20

The second method offers the further advantage of revealing whether a low or a high agglutination titer is present when a universal donor is used. The agglutinins in the plasma of the donor mixture are first diluted five times and then are diluted six times more by carrying 1 drop of the mixture to the donee mixture, giving a thirty fold dilution. If an alpha titer of 1/32 is present in the plasma of the universal donor, the red cells in the citrate mixture of an A donee will still agglutinate but not if the titer is 1/16. Use of citrate solution eliminates fibrinogen clotting which jeopardizes evaluation of agglutination when a physiologic salt solution is used as the diluent. Without sodium citrate tiny gray, whitish floccules of fibrin form invariably and always adsorb individual red cells. This can easily be mistaken for agglutination by the unwary.

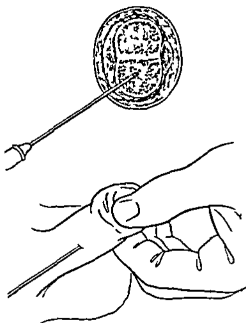


Fig 46.—Venipuncture using corpus cavernosum. Needle tip must be in the erectile tissue composed of venous sinuses. Puncture site should be on lateral surface where there is no danger of injuring urethra or dorsal vessels. While the needle may be inserted as shown it is satisfactory and more convenient to direct it toward the base of the penis (Phelps below)

Emergency Vein.—Venipuncture in the average individual is easy and safe provided a few basic precautions are observed. In some cases, however, it is difficult or impossible. These instances are probably encountered more frequently in treating the war casualties. Since

battle casualties are males, intravenous medication or infusions can eventually be given through the corpus cavernosum of the penis Malcom E Phelps[2] (El Reno, Okla) describes a procedure first presented by Shaw in 1928

TECHNIC—A site is selected over the corpus cavernosum While the penis is held firmly, the needle is inserted obliquely through the skin and Buck's fascia into the corpus cavernosum, with the point toward the base Ordinarily blood cannot be aspirated when the needle is in place With a little care there is no danger of puncturing the urethra or dorsal vessels Slightly more pressure is needed for injection than in ordinary intravenous infusions owing to resistance of fibromuscular tissue, but rate of flow may be as rapid as in other intravenous routes Irritating solution should not be used because of risk of a chronic cavernositis, but this method is ideal for both blood plasma and citrated blood

This route is not recommended if subcutaneous veins are accessible Although the field is limited, it is encouraging to know that there is always an "available vein"

Improved method for administration of human plasma and whole blood is described by M D Willcutts and R A Hicks[3] (M C, U S N) The ordinary gravity flow equipment is defective because it does not provide for rapid administration of fluids is wasteful of pure gum rubber and requires specialized cleaning processes to avoid pyrogens Substitute administration units made of cellophane do not meet all requirements of dependability, practicability and economy

The authors' equipment (Figs 47 and 48) obviates these disadvantages Cleaning and sterilization are essentially those required for preparation of an ordinary syringe An operator with two of these sets may continuously administer plasma by giving several units with one outfit (changing needle and adapter only between patients) and having that apparatus promptly disassembled, cleaned boiled and reassembled while he works

(2) South. M J 35 1031 109 December 1942
(3) U S Nav M Bull 41 913 16 January 1943



Fig 47 —Apparatus for administration of plasma by air pressure coarse strainer visibl inside plasma container Fine filter disk is inside the flat bakelite container shown in the line Minimal rubber tubing used. Air filtration is not essential S de arm syringe is excellent but in field work may be replaced by glass adapter and pinch clamp All tubing connections are secured. Tubing is slightly longer than necessary but after several uses the stretched tips should be cut off This set may be attached to a ? 000 cc bottle and a series of plasma units admin stered to eight patients by changing adapter and needle only Bent wire clothes hanger or gauze strip may be used to suspend flask f om operator s neck Rate of flow is cont olle l by pinch clamp or degree of air pressure Pyrogen problem in infusion equipm nt is obviated and cleaning preparation and sterilization are simplified This equipment facilitates rapid administration of plasma when speed may be desirable

with the second set The number of infusion sets required is governed more by the number of operators available than by the number of plasma units to be dispensed A further advantage is that a small needle may be used and any desirable rate of flow still obtained by increas



Fig 48—Apparatus for administration of whole blood strainer inside flask not visible line filter not required This type of equipment supplied routinely throughout a mobile staff of 140 doctors serious difficulties have not been encountered

ing the pressure developed above the liquid When high pressure is used to speed flow through a small needle the rubber connections must be well secured Universal adoption of this method would facilitate intravenous administration of all fluids and save great amounts of rubber

Hemo Irradiation—*Blood Irradiation (Knott Technic) in Acute Pyogenic Infections*—The method of irradiating human blood consists of withdrawing and citrating venous blood and immediately returning it intravenously through a closed system containing a Knott irradiation chamber at which point intense ultraviolet irradiation is applied The amount of blood used (predetermined according to approximate body weight and rarely exceeding 300 cc), the time of exposure (optimally 10 12 seconds in treatment of acute pyogenic infections) and the wavelengths and intensity of the spectral energy used form the basis for estimating and maintaining a relatively constant dosage

George Miley[5] reports 151 cases of acute pyogenic infection treated at Hahnemann Hospital, Philadelphia, in three years Clinical response has been excellent

There was rapid subsidence of toxic symptoms with subsequent recovery in all of the early cases, all but one of the moderately advanced cases and some of the apparently moribund cases Other beneficial physiologic effects e g , bactericidal effect, vasodilation venous oxygen increase were also observed

No case of acute pyogenic infection uncomplicated by septicemia, after receiving ultraviolet blood irradiation therapy, has progressed to septicemia

The Knott technic must be considered a method of applying ultraviolet energy intravenously The earlier it is used, the better the results It is essentially a hospital procedure It requires careful training in its use and, properly administered is without harmful after effects It offers more to the patient than any other therapy known

To control infection it is the obvious method of choice in cases of acute pyogenic infection in which chemotherapy has failed In general, whenever a bactericidal, detoxifying or vasodilating effect is needed, as

(5) Am J Surg 7 433 50 September 194

well as such other effects of ultraviolet as increased ability of the blood to absorb oxygen and increased general resistance the Knott technic of ultraviolet blood irradiation therapy is indicated

In *five years experience with hemo irradiation* according to the Knott technic, Henry A Barrett[3] (New York City) treated over 400 patients having a variety of conditions infections of various kinds systemic and regional, including the eye He has used the method in 30 cases of asthma and 60 of arthritis rheumatoid, infectious and osteo arthritis In all about 35 different conditions have been treated

Long before the Knott technic of hemo irradiation was introduced, ultraviolet spectral energy had proved to be a therapeutic agent of pre eminence in rickets, infantile tetany, extrapulmonary tuberculosis erysipelas lupus vulgaris various skin conditions, etc

By the Knott technic the scope of therapeutic usefulness of ultraviolet radiation has been considerably increased so as to include bacteremias, toxemias, peritonitis thrombophlebitis and other serious infections in which the operator can now anticipate prompt and effective action even when sulfonamide therapy and ordinary transfusions fail The method raises the general resistance of the individual diminishes toxemia rapidly and stimulates the healing forces of the body It is safe and causes no untoward reactions It can be used to supplement other recognized measures operative and medical, but in its own right it is a measure which will often effect a cure when all other therapy has failed

Nine illustrative cases are offered as evidence of the unusual therapeutic properties of this method

George Miley[4] (Hahnemann Med College) used the Knott technic of *ultraviolet blood irradiation therapy for acute thrombophlebitis* in 13 consecutive cases with highly satisfactory results

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(3) Am J Surg 61 1 3 Jul 1943
(4) Ibid 60 354 360 June 1943

Rapid disappearance of pain and tenderness was observed, usually in 24 to 48 hours following a single blood irradiation A drop to normal of abnormally high temperatures, when present, occurred in 48 to 72 hours In 12 cases the edema subsided completely in 13 to 15 days In the thirteenth case marked induration was associated with edema and neither had disappeared when the patient left the hospital on the eighth postirradiation day Complete absence of untoward effects was evident in all patients treated

Five cases were good examples of failure of sulfonamides with local heat bed rest and elevation of the involved extremity to control thrombophlebitis, four received only ultraviolet blood irradiation therapy and bed rest three had failed to respond to local heat, bed rest and elevation of the extremity, and one showed no effects in 50 days, after four therapeutic nerve blocks to influence the process Apparently, permanent indurative damage had occurred

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BONES

Rate of Absorption and Callus Stimulating Properties of Cow Horn, Ivory, Beef Bone and Autogenous Bone — Charles W Hughes[5] (Loyola Univ, Chicago) made his experiments on dogs and rabbits He found that in long bones foreign substances located in bone cortex are absorbed slowly Substances in the medullary cavity are absorbed more rapidly and materials which are extra cortical in position are absorbed most rapidly Absorption of the extracortical portion of autogenous and beef bone pegs is perceptible after one month The same is perceptible in ivory (not boiled) pegs after six months and in cow horn pegs after nine months

When the amount of callus formed around an autog

(5) Surg Gynec & Obst. 76 665 671 June 1943

enous peg is considered as a unit, there is one third more callus around a beef bone peg and one half more around ivory or cow horn pegs There is no firm union between ivory or cow horn pegs and the host bone Microscopically, it appears that there is definite bony union between the autogenous or beef bone pegs and the host bone Thus, beef bone is a much better substitute for autogenous bone grafts than ivory or cow horn

Osteomyelitis—Clarence Dennis[6] (Univ of Minne sota) recommends *prolonged dependent drainage with lucite drains in the treatment of chronic osteomyelitis*

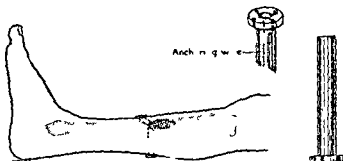


Fig 49—Lucite drain 1 cm in external diameter and 7 mm internally length varies. At one end is a flange 18 mm in diameter in which holes are drilled Drains are inserted to allow dependent drainage of osteomyelitic cavities regardless of whether patient is recumbent or upright Flange of anterior drain is bent to be parallel with skin A stainless steel wire passes through both drains and leg and is anchored to each flange

The most satisfactory use of these drains is in osteo myelitis of the tibia in which it is possible to maintain dependent drainage regardless of whether the patient is recumbent or upright In the first case in which the method was tried the drains were inserted as shown in Figure 49 and subsequent cases have differed from this only in minor details

TECHNIC—The skin and soft tissues over the anterior sur face of the tibia were incised the bone was opened anteriorly into the pocket, and most of the bony roof of the cavity was removed At the caudal end of the cavity, a 1⅜ in drill was used to penetrate the bone straight back, and the gradu

(6) Surgery 13 900 910 June 1943

ated diameter trocars of Wangensteen's set for drainage of lung abscess were pushed through the soft tissues and skin posteriorly until a large enough trocar was reached to permit placement of a lucite drain from behind It was quickly learned that the head of the drain must lie about 4 mm away from the skin at first, to prevent pressure irritation from postoperative swelling of the calf muscles The anterior drain site was exposed by excision of a disk of skin and soft tissue 1 cm in diameter and a hole for the drain was drilled upward and backward *at an angle of about 45 degrees* The head of the anterior drain was placed in hot water and bent to lie parallel with the skin on insertion The bone cavity was loosely packed with dry gauze, which was withdrawn during the next few days

To secure the drains in place stainless steel or silver wire was passed through the lumens of both drains and anchored to the flange of each drain Burial of the ends of the wire in a hole of the flanges prevents catching of the dressings on the ends A plaster cast was applied leaving a wide margin to facilitate change of dressings without contamination As soon as the soft tissues were healed (in about two weeks), the cast was removed and full activity allowed Daily irrigation with Dakin's solution was used to keep the drains open in most cases

Twelve lesions in 11 patients were treated in this fashion In general, one or two drains were placed in each bone pocket Apparently complete healing occurred in four patients, frank failure resulted in two and five are still under treatment Three of the latter offer definite promise of ultimate success In one case the drains were removed too recently to allow certainty

One of the failures was in disease of the humerus in a fat muscular girl 11 in whom the drains could not satisfactorily be held in place they probably were not properly inserted Healing took place later under chemotherapy In the other failure the disease involved the lower femur and the bone was of such poor quality that openings for insertion of the drains were made with the thumb nail The bone has become strong enough to permit the use of the leg and all pain has been relieved, but profuse drainage persists after 30 months and removal of the drain is not tolerated Striking relief of the dis

comfort and ache of chronic osteomyelitis was observed after proper placement of the plastic drains

The proper period during which drains should remain in place has not been settled For the larger bones it appears wisest to shorten or remove drains only when roentgen evidence indicates healing at the end of the drain In the tibia, this has meant about 15 months of drainage

Tumors—Louis Lichtenstein and Henry L Jaffe[7] (New York City) studied 10 central and 5 peripheral *chondrosarcomas of bone* and reviewed the cytology of the benign growths (27 solitary benign enchondromas and 50 solitary osteochondromas or osteocartilaginous exostoses) from which chondrosarcoma so often evolves

Chondrosarcoma is distinct from osteogenic sarcoma of bone The former develops from full fledged cartilage and the latter from more primitive tissue, the bone forming mesenchyme Some chondrosarcomas show large areas in which the intercellular matrix of the tumor cartilage has become heavily calcified or ossified, and in some osteogenic sarcomas cartilage in considerable amounts may be formed in the course of osteogenesis from the primitive mesenchyme However chondrosarcoma never shows tumorous osteoid tissue and bone evolving from a sarcomatous stroma directly such as one always sees somewhere in osteogenic sarcoma, no matter how much cartilage it contains

Compared with osteogenic sarcoma chondrosarcoma is less common, appears at a later age (on the average) runs a much slower course and, especially if given radical surgical treatment at an early stage, has a much better prognosis, since the tumor has usually not yet metastasized at the time of initial surgical intervention Even when the tumor is inadequately extirpated, it tends to recur only locally one or more times before extending to the tributary veins or the lungs Local trauma does not seem to be a factor in the initiation of

(7) Am J Path 19 3 589 July 1943

chondrosarcoma or an malignant transformation of en chondroma and osteochondroma

A central chondrosarcoma begins in the interior of a bone and a peripheral one in the cartilaginous cap of an osteochondroma It is in the latter and those central ones which have clearly evolved from benign enchondromas that one finds, at least in the earlier stages of evolution of the lesion heavy calcification or ossification of large parts of the intercellular matrix of the tumor cartilage In other chondrosarcomas the relevant neoplastic tissue is likely to consist, in the main, of compacted islands of cartilage with hyaline matrix, though if the chondrosarcoma is bulky, areas in which the cartilage is softer and myxomatous and perhaps even necrotic may also be found

Although it is true that the histologic picture of a particular lesion (irrespective of its gross appearance) does not have to be crudely and obviously sarcomatous to indicate chondrosarcoma, it is a mistake to suppose that to make a diagnosis of chondrosarcoma on a histologic basis alone is often difficult if not impossible Even in the early stages of a chondrosarcoma one will find, at least in scattered fields, if adequate material is examined subtle but tell tale evidences of cytologic atypism of the cartilage cells which will betray the malignant character of the lesion A cartilage tumor should no longer be regarded as benign if when viable and not heavily calcified areas are examined it shows even in scattered fields (1) many cells with plump nuclei, (2) more than an occasional cell with two such nuclei and especially (3) any giant cartilage cells with large single or multiple nuclei or with clumps of chromatin The prevalent tendency to "underdiagnosis" of chondrosarcoma in an early stage of malignancy can be overcome by observing these criteria

FRACTURES—GENERAL

Minimal requirements for fracture treatment are discussed by James J Callahan[7] (Chicago) Roentgen examination is essential and the ideal individual splint is the plaster of paris cast

Several basic principles must be adhered to (1) Approximate distal to proximal fragment (2) Consider normal weight bearing line, i e, from the anterior superior spine of the ilium through the middle of the patella and between the first and second toes (3) Do not permit posterior or medial displacement (4) Maintain carrying angle in fractures of the humerus (5) Do not try to hold a fracture in correct position by pressure, because of danger of soft tissue necrosis and of delayed union or nonunion (6) Keep in mind that traction is far more important than manipulation and that many complications result from manipulation and not the accident itself (7) Use moleskin adhesive plaster or skeletal traction

Fractures of the humerus should be placed in extension with the arm in supination except impacted fractures of the neck fractures without displacement and supracondylar fractures The last are immobilized in a cast including the forearm, wrist and hand Fractures of the upper third of the forearm are placed in supination and right angle flexion with cast extending from metacarpophalangeal junction to midarm, of the middle third in midpronation and supination and right angle flexion at the elbow of the lower third, in pronation If traction is necessary, the skeletal type is indicated

All fractures of the femur from neck to supracondylar area require traction with moleskin adhesive placed laterally on the leg and secured by elastic bandage The maximal amount of weight should be used early while

(7) Illinois M J 83 31 34 January 1943

the moleskin has maximal adhesive qualities and skin is in good condition, weight can then be gradually reduced

Fractures of lower leg including tibia, ankle and foot are immobilized in a cast When traction or manipulation is necessary to reduce the fracture, a posterior mold cast should be applied If traction is necessary, the skeletal type should be used

Special rules are given for using skeletal traction (1) It should not be inserted within 6 in of a simple fracture or compound fracture will result, except where a joint intervenes (2) Distraction frequently causes delayed union or nonunion by pulling the bone surfaces apart (3) Pes cavus or contraction of the plantar fascia should be avoided (4) No dressings are applied around the pins, wires or hooks, as they encourage infection and drainage Site of election for insertion of skeletal traction in the leg is the os calcis, the pin being driven in from medial to lateral side away from posterior tibial vessels Kirschner wires or small Steinmann pins are inserted by drilling into the tibial tubercle Skeletal traction is never inserted in the supracondylar area because of proximity of knee joint A large screw is used for traction through the greater trochanter into neck and head of femur for acetabular fractures in which the head is pushed through, resulting in central dislocation or perforating fracture

In the upper extremity, Kirschner wire is inserted about 1 in proximal to the heads of the metacarpals For traction on the forearm and arm, it is important to insert the wire from the ulna to the radius so as not to miss the ulna For the elbow a hook that can be bought at any hardware store is inserted into the ulna through a drill hole about 1½ in distally from the olecranon Traction is then applied in this area with moleskin on the forearm for flexion or extension

Sixty five per cent of pelvic fractures can be treated by rest in bed with a board under the pelvis If com

pression is required, a sling can be used having a seat that can be dropped for toilet purposes In upward displacement of the entire side of the pelvis, straight leg adhesive traction should be applied

Instead of the Taylor spine brace for compression fractures of the vertebrae Callahan suggests a brace that will immobilize from the sternal notch to the symphysis pubis to prevent forward flexion, and a chair back brace to prevent lateral rotation or motion, thus eliminating the deformity that frequently occurs after an excellent reduction

Paratrooper Fracture —In two years' observation of the fractures occurring among parachute jumpers, or "paratroopers," in training at Fort Benning, Ga, William J Tobin[8] noted a number of fractures of the posterior articular margin or "posterior lip" of the tibia (Fig 50) Those occurring alone constitute about 12 per cent of the total fractures At least another 4 per cent consist of fracture of the posterior lip of the tibia associated with fracture of the internal or external malleolus At times the fracture of the posterior lip occurs with bimalleolar fracture, forming the trimalleolar fracture of the ankle joint

Usually the fracture is not severe No case in the series studied required open reduction Undoubtedly, the high, tight fitting boots worn by the jumpers explain this The astragalus is not pushed back appreciably, and consequently the posterior ligamentous structures, while stretched and partially torn are not completely separated

An interesting observation has been that the jumpers often "reach for the ground" when about 20 ft from it As a result the foot is in plantar flexion The force of impact with the ground can be compared to that of a man running and then jumping from a platform 12 ft high With the foot in plantar flexion, the posterosuperior articular surface of the astragalus which presents

(8) Arch Surg 46 780 78- May 1943

this structure's most narrow transverse diameter, is in contact with the articular surface of the tibia In this position it is less firmly locked than in dorsiflexion, and the posterior articular ligament is relaxed hence little or no support is presented to the force transmitted up



Fig 50—Typical fracture of posterior lip of tibia which usually occurs alone no appreciable separation of fragments

through the long axis of the foot through the astragalus to the lower end of the tibia The result is a shearing off of the posterior articular surface of the tibia

Whether the fracture of the posterior lip occurred alone or with a fracture of the external malleolus treatment consists in immobilizing the joint for an average of four weeks in a skin tight plaster cast with a walking

tion attached Incomplete fractures required less time than those in which separation of the fragments had taken place Jumpers with uncomplicated fracture of the posterior lip were allowed to return to jump training after an adequate period, seldom under three months Men with trimalleolar fracture were recommended for a permanent nonjump status

Appliances—Earl D McBride[9] (Oklahoma Univ) recommends use of a *plated osteoperiosteal graft* in the presence of chronically infected tissue, delayed union, nonunion with loss of substance and as sliding graft in nonunion of the tibia When the osteoperiosteal graft is squarely covered by a smooth, flat vitallium plate and gently but firmly squeezed to its bed on the bone fragments by the usual screw fixation, neither absorption nor necrosis occurs On the contrary, the overlying support protects against erosive influences and the firm contact of the graft with its host bed promotes permeation of budding vessels and proliferating osteogenic cells

TECHNIC—In compound fractures, preoperative preparation should include attention to chronic scars, sinuses and ulcerations The incision for exposure of the ununited fragments should avoid scar tissue or healed sinuses as widely as possible The graft is best taken from the tibia In a previously infected field when the graft is taken from one of the fragments of the tibia there should be two carefully separated incisions The graft should be taken first to prevent contamination or the instrumentation should be divided one for each field The graft is cut thin and accurately with a saw and a thin osteotome it should be slightly longer and wider than the plate and of uniform thickness Instead of chipping it endwise with a chisel placed on the flat surface of the tibia it is preferable to retract the muscles from the lateral margin of the tibia and start the chisel or bone saw about 3/16 in below the crest By being cut transversely at this depth parallel with the anterior surface of the tibia the graft remains flat and does not curl up Before cutting the bone laterally, the size of the graft should be outlined on the anterior surface with the osteotome, driving it 3/16 in deep

(9) J A M A 121 65 6 5 Feb 1943

The extent of readjustment of the fragments depends on the nature of the malunion or deformity The periosteum of the fragments should be carefully elevated and conserved If possible, the intervening fibrous tissue and callus should not be excised or disturbed Local trauma should be as mild as possible, especially when chronically infected scar tissue prevails The surface of the cortex of both fragments is evenly flattened as a receptive bed for the graft which is then spanned across the fibrous gap and smoothly fitted to its bed In the tibia, the graft is plated preferably to the lateral aspect of the bone Good muscle covering should be sought in other bones In compound fractures, when an inflammatory reaction may occur, the wound is dusted and all raw surfaces are rubbed with a half and half mixture of powdered sulfathiazole and sulfanilamide

The retracted periosteum of the host fragments is evenly brought up over the slightly extended edges of the graft and over the plate as much as possible to seal in and protect the graft Plaster immobilization is applied In four to six weeks regeneration of bone, in addition to the sustaining adequacy of the metal plate, affords passive and active motions in uncomplicated cases The plate need not be removed after union unless there is irritation

The method was used in 17 cases Union was obtained in all Osteogenesis, as followed by roentgen examination compared favorably in rapidity and quality with that which might have been expected from a full thickness graft The rapid ossification of the intermediary tissue between the ununited fragments made it seem unnecessary to remove this tissue

Ernest H Bettmann[1] (White Plains N Y) uses a *method of femur traction with foot rest* which avoids the difficulties inherent in skeletal or skin traction and utilizes the condyle region of the femur as a working point This cone shaped region with the crest of the condyle laterally, the upper patellar margin anteriorly and the popliteal fossa posteriorly forms a triangle on which an even pressure and pull find safe anchorage without involving distal joints The method offers the following advantages It exerts a steady pull above the knee joint by a circular grip which is automatically

(1) J Bone & Joint Surg 4 0 4 April 1943

tightened when traction is increased, the foot is placed comfortably in an adjustable foot rest, preventing faulty position and deformities, and the apparatus can be applied and removed immediately in patients of any age who require traction of the hip or femur. The apparatus shown in Figure 51 is described.

APPARATUS.—Two duraluminum bars 20 in. long (*1*), crossing 6 in. below the proximal end to form an ice tong device, are fitted with two padded aluminum pads (2). These pads, connected by two pairs of straps which buckle to them, fit closely to the distal end of the femur and, being shaped in a semicircular base, form a tight condylar rest. A cord connecting the distal arms brings them together more with increasing weight pull and thus causes a proportional tightening of the pads. This is followed by adjustment of the foot rest, consisting of a cross bar (*3*) which glides at right angles to the traction pull and is adjustable on the traction arms by screw devices with pivots (*3A* and *3B*). A sole piece (*4*), allowing horizontal and up and down motion on the bridge by three screws which glide in slots (*6*), guarantees proper foot position. An adjustable leather band (*5*) supports the calf.

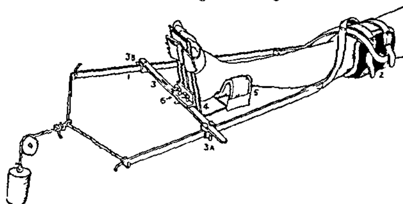


Fig. 51.—Traction adjusted.

This automatic "ice tong" method has been used in 15 cases of Legg Perthes disease, in 3 cases of coxitis with flexion contracture, in 2 of spastic paraplegia with drop foot, in 8 of low back pain with arthritic changes or sciatic syndrome and in 2 of involvement of the hip in Gaucher's disease.

The apparatus has been applied with traction from 6 to 15 lb, for three days to four months, during which time the traction has been kept on constantly, or removed daily or weekly for additional therapy or examination Most patients were children between 5 and 16 A group of adults with low back pain has also been treated with this method

Kenneth M Lewis and Lester Breidenbach (Bellevue Hosp) and Otto Stader[8] (Ardmore, Pa) present the *Stader reduction splint* for treating fractures of the shafts of the long bones This splint makes early transportation of the patient possible, which is important in bombed areas and in civil or military surgery It is simple to apply, and correction of malposition of the fragments is possible in all three planes of space even up to the time of fibrous union Early weight bearing and continued use of the contiguous joints are permitted and urged, thus preventing muscle atrophy and stiffening of the joints After treatment is reduced to a minimum, as muscle strength is retained and joint function carried on Seepage round the pins has sometimes been observed between the fourth and the sixth week It is usually due to galvanism, not to infection, and is not an indication for removing the pins unless accompanied by signs of inflammation It has been largely overcome since the pin bar was made of plastic instead of metal

Since 1937, 20 patients have been treated by this method Results have been uniformly good In three patients, infection around one or more pins occurred, but promptly subsided when the pins were removed No osteomyelitis has been observed except in the femur of a woman, 84, who should not have been selected for a trial of the method The splint has been kept on until union occurred, and this has varied from 8 to 16 weeks

APPARATUS —The mechanical features of the reduction splint are detailed in Figures 52 and 53 The stainless steel pins (*A*)

(8) Ann. Surg 116 623 636 October 1942

tightened when traction is increased, the foot is placed comfortably in an adjustable foot rest, preventing faulty position and deformities, and the apparatus can be applied and removed immediately in patients of any age who require traction of the hip or femur The apparatus shown in Figure 51 is described

APPARATUS —Two duraluminum bars 20 in long (*1*), crossing 6 in below the proximal end to form an ice tong device, are fitted with two padded aluminum pads (2) These pads, connected by two pairs of straps which buckle to them fit closely to the distal end of the femur and, being shaped in a semicircular base, form a tight condylar rest A cord connecting the distal arms brings them together more with in

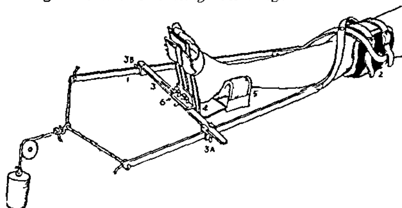


Fig 51 —Traction adjusted

creasing weight pull and thus causes a proportional tightening of the pads This is followed by adjustment of the foot rest, consisting of a cross bar (*3*) which glides at right angles to the traction pull and is adjustable on the traction arms by screw devices with pivots (*3A* and *3B*) A sole piece (*4*), allowing horizontal and up and down motion on the bridge by three screws which glide in slots (*6*), guarantees proper foot position An adjustable leather band (*5*) supports the calf

This automatic "ice tong" method has been used in 15 cases of Legg Perthes disease, in 3 cases of coxitis with flexion contracture in 2 of spastic paraplegia with drop foot in 8 of low back pain with arthritic changes or sciatic syndrome and in 2 of involvement of the hip in Gaucher's disease

be introduced into traumatized tissue, which is often devitalized, the muscle groups would have a greater purchase on the bone fragments, by virtue of the fulcrum produced by the instrument, and this would throw

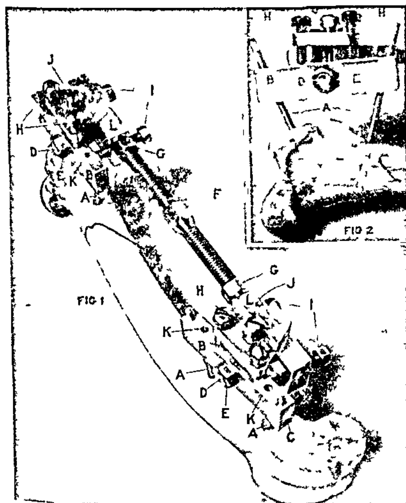


Fig 5 and Fig 3 (inset)

greater stress on both the instrument and the fractured bone, and it would be more difficult to reduce the fracture successfully because of the muscular action on the extremities of the bone

are made of a special alloy which resists corrosion when embedded in tissue The sharp end is similar to the end of a trocar, while at the other end there is a flat surface for the set screw of the pin handle In applying the instrument, the pins are placed through the desired holes in the pin bar (*B*) and locked by a set screw (*C*) There are four holes (*A*) in each pin bar, the two extra ones being for the purpose of selection

If there is a short fragment on one end of the fracture, it may be necessary to use the two pin holes nearest to each other, while on the long fragments the pin holes farther away from each other may be desired The two pins, when inserted through the pin bar, form an angle One of the pin assemblies (pin and bar) is placed above the fracture and another below

The two pin bars are bridged by the extension bar by means of hinge bolts (*D*) inserted through the large central hole in the pin bar and tightened by means of nuts (*E*) To overcome over riding of the fragments the extension bar (*F*), which is in effect a turnbuckle is activated by a wrench so as to cause the pin bars to travel away from each other

By manipulation of the screws (*H*) which contact the pin bar from above, accurate alinement of the fragments in the mediolateral plane can be accomplished Nut *E* should be slightly loosened before the adjustment is made

By manipulation of screw *I*, each pin bar assembly and fragment can be accurately alined in the anteroposterior relationship

After the adjustments have been completed and checked roentgenographically the lock nuts (*G*) on the extension bar are tightened firmly against the hinge block (*L*) This locks the instrument for extension and rotation The nuts (*E*) on the hinge bolt (*D*) are now firmly tightened and the set screws (*I*) are firmly set, which locks the remainder of the instrument The reduction instrument then assumes the role of a splint

To reduce the weight of the instruments, most of the parts are made of duralumin, the parts absorbing great strain are made of stainless steel

The pin assemblies are placed as near the extremity of the bone as possible for the following reasons The first principle in treating a fracture of the shaft of a bone is to correct over riding As the muscles causing over riding mostly have their origin and insertion at or near the bone extremities it seems logical to inactivate them at these points There are serious objections to placing the pins near the point of fracture They would

The second pin is introduced in the same manner while an assistant raises the pin bar about ¼ in above the skin surface The second pin assembly is then placed in position When the four pins are in place, they are locked with the small hexagonal wrench by set screws in the end of each pin bar

To apply the extension bar, adjusting screws *I* and *H* are unscrewed so they will not interfere with slipping the extension bar onto the pin bars Lock nuts *G* on the extension bar



Fig 54 —Pins and pin bars in place extension bar about to be applied

are loosened to facilitate extension or contraction as well as rotation From a strictly mechanical point of view, there is no reason why, if there were 2 in of over riding in a given fracture, the extension bar could not be adjusted so that it would slip onto the pin bars with this degree of over riding present with the idea of then proceeding to overcome shortening and then the other types of displacement However, much time can be saved if the operator grasps the pin assembly in each hand and manually overcomes as much of the over riding as possible before applying the lateral extension bar In this way fully 75 per cent of the reduction maneuvers will be accom

Careful skin preparation is essential, and the same surgical aseptic safeguards should be observed as in any surgical procedure on bones The splint should be applied only in the operating room and sterilization is necessary

TECHNIC —As a general rule the upper pin assembly is placed first One pin is placed into the pin handle or in a flexible shaft drill and tightened firmly into place with the set screw The pin is introduced through the desired hole in the pin bar, and then this assembly is held in the right hand With the left hand, the point for pin no 1 to enter is accurately determined Steadying the area with the skin stretched toward the fracture by the left hand, the right hand introduces the pin and by firm, steady pressure forces the pin through the skin and soft tissues onto the outer cortex of the upper fragment of the bone

By firm pressure and rotation, the pin is firmly seated into the outer cortex Then, by deep palpation on the medial side of the limb the upper fragment is steadied while the pin bar is brought into parallel alinement with the long axis of the upper fragment by slightly altering, if necessary, the angle of introduction of the pin which up to this point has only been seated After the upper fragment and pin bar have been brought into parallel alinement, continued pressure and rotation of the pin handle will introduce the pin through the outer cortex, through the medullary canal and then through the inner cortex Care should be exercised so that the pin points definitely emerge through the inner cortex This can be ascertained by a gradual release of resistance as the pin points start to emerge, as well as by deep digital palpation, which will frequently reveal the pin points through the inner cortex

Insertion of the pins is difficult in some instances, especially where the cortex of the bone is unusually thick Drilling a hole with a bone drill slightly less in diameter than the pins to be used will overcome the problem The pin is then introduced through the tract of the drill

When using a drill it must be passed through the pin block so that the hole will assume the proper angle The drill should seat well into the distal cortex and when the pin is inserted it should be forced into the opposite cortex by pressure and rotation

An alternate method is to insert the pin into a Magnuson motor driven drill handle adapted to receive the pin No preliminary drilling is required, but care must be taken that the pin is not driven too far through the distal cortex, if it is, it may be withdrawn to the proper depth

a rigid technic of thorough debridement and flushing is followed, dirty instruments and drapes are discarded before repair is done (5) Wounds are closed only if they have been seen before or during the eight hour safe period and if no tension is present (6) Sulfanilamide or sulfathiazole is sprinkled about the wound before closure (7) After reduction a snug plaster is applied

Several patients had lost so much skin that closure was impossible, in which event Trueta s suggestions were followed When sufficient granulation tissue had formed, multiple pinch grafts were applied No infection developed in the series Nonunion occurred in a compound comminuted fracture of the humerus in a patient whose arm was caught between two freight cars, causing destruction of much of the bony substance and soft tissues Amputation was refused and he was treated by the Trueta method, with good cosmetic result With a brace he can use his arm for minor functions All tibia fractures healed the period of union varying from 16 to 40 weeks

Frederic W Ilfeld[1] (M C, U S A) has used *carbamide sulfonamide mixtures* in the treatment of 41 patients with compound fractures and other serious traumatic injuries After the surgical procedure proper was completed, 1 6 oz of the powder was sprinkled and packed into every part of the wound, the quantity used depending on the extent of the lesion No attempt was made to close the various layers of the wound The skin alone was approximated by a perpendicular mattress suture of silk

Application of the mixture to fresh contaminated wounds as a first aid measure permits a long delay before definitive surgery Use of a solution of the mixture for irrigation and implantation of the powder permitted primary closure and healing of contaminated wounds

Influence of Sodium Beta Glycerol Phosphate on the Healing of Experimental Fractures —Louis Sperling

(1) Surg Gynec & Obst 6 4 7 437 April 1943

plished in 30 seconds While the operator maintains this position (Fig 54), the assistant adjusts the extension bar to the right length and slips the stud bolts (*D*) through the holes in the pin bar and then screws on the nut *E* Before the operator lets go of the pin bar assemblies, the adjusting screws *I* and *H* are snugly set with the fingers only

By properly manipulating the extension bar nut (*F*), the necessary degree of extension is easily secured This can be checked in many instances by deep palpation

Mediolateral alinement of either segment is obtained by manipulation of adjusting screws *H* When this adjustment is being made, nut *E* should be slightly loosened, after it is secured, the nut is firmly tightened Each segment can be manipulated in the anteroposterior plane by set screws *I* The patient is then moved to the roentgen department where final adjustments are accomplished under fluoroscopic guidance or by taking several films

The pins should not be put in place with the aid of the fluoroscope because too much exposure would be necessary and would endanger the patient and the operator, sterile surgery is impracticable in the x ray department, and accurate knowledge of the anatomy involved makes fluoroscopic guidance unnecessary

An important factor in treatment of the fractures is to see that firm impaction of the fragments is secured As a final adjustment it is well to impinge slightly the fragmented ends on each other By firmly setting all adjusting screws, the entire instrument becomes a splint

Compound Fractures —Charles J Frankel and Robert V Funsten[9] report on 28 compound fractures of long bones treated in 12 months at the University of Virginia Hospital 20 with adequate follow up All patients were seen within 8 hours, except one who was brought to the hospital about 24 hours after a femur fracture Only two were children

Since compound fractures of ward patients are handled by a changing house staff, supervised by a resident a routine was formulated (1) Immediate splinting is done (2) The wound is sprinkled generously with sulfanilamide sulfathiazole or both (3) Treatment for shock is instituted (4) In the operating room

(9) J A M A 1 (1 84 Dec 6 194

group, much callus remained adherent to the membrane, while this was not the case in the untreated group

The drug is apparently well tolerated by the experimental animal in a dosage of wide range and seems to stimulate and hasten the reparative process and the production of bone callus Its clinical trial is suggested

Pseudarthrosis—William T Green and Nathan Rudo[2] (Harvard Univ) describe the case of a girl, 7 who presented bowing tibial and fibular pathologic fractures, and *pseudarthrosis with neurofibromatosis* Pathologic examination revealed intra osseous neuro fibroma as a factor in production of the fractures and in retardation or prevention of union

In cases of "congenital pseudarthrosis" the patient should be examined for stigmas of neurofibromatosis which include cafe au lait spots extra osseous tumors and roentgen evidence of other skeletal defects In operations on patients with "congenital pseudarthrosis" the possibility that the process may be due to the presence of neurofibroma in the area should always be considered If neurofibroma is the cause of the pseudarthrosis incomplete excision of the tumor with local recurrence may be a factor in nonunion

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SCALP AND SKULL

Skull Fractures—Donald Munro[3] (Harvard Univ) presents an analysis of 218 cases of all types of *compound fractures of the skull*

Four principles are fundamental in the surgical treatment of these fractures All wounds must be completely debrided within 48 hours of injury or not operated on until entirely healed for six to eight months No patient should be operated on until he is out of surgical shock and his general condition warrants it After diagnosis

(2) Arch Surg 46 6 9 651 May 1943
(3) New England J Med 28 3 45 June 10 1943

W D Armstrong and Sidney Laton[2] (Univ of Minnesota) state that there is no conclusive evidence that delay in healing of fractures, or calcification of the hematoma, is due to a quantitative deficiency of phosphatase or to absence of sufficient mineral salt at the site of fracture The humoral source of bone salt is essential for the normal process of healing, and it appears possible that one of the factors limiting the speed of calcification is the low plasma content of ester phosphorus hydrolyzable by phosphatase essential to precipitation of calcium in callus and new bone formation Therefore they investigated the effect of intravenous injections of sodium beta glycerol phosphate on the rate of healing of fresh experimental fractures As far as can be determined this ester of phosphoric acid has not previously been used in experimental or clinical studies on the healing of fractures

METHOD —The right radii of rabbits were fractured under ether anesthesia Roentgen examination revealed that the fractures usually were transverse and that the fragments were in alinement with little comminution of the bone The undamaged ulnas served as effective splints Twenty seven animals received 6 14 daily injections by ear vein, of 0 1 Gm sodium beta glycerol phosphate in 4 cc solution, and 22 animals with similar fractures served as controls, receiving a like number of injections of 4 cc physiologic saline

Roentgenograms of the limbs taken before and after removal of the soft tissues revealed an increase in callus about the fracture site in the group treated with the drug The fracture callus of the animals receiving 8 14 treatments was greater in amount and more firm to palpation than that of the controls After cleaning the bones it was noted that even though some of the callus was lost when the periosteum was removed, the healing of the fracture appeared to have progressed further in the treated animals The hard callus was larger and the fracture defect was more nearly bridged over than in the controls On stripping the periosteum in the treated

(2) J Bone & Joint Surg [illegible] 1 84 Oct [illegible] 193[illegible]

is scarified adjacent to all skin sutures deeply enough to draw blood, particular attention being paid to the corners Mattress sutures of silkworm gut are occasionally used as tension sutures All suturing is done from the periphery toward the center of the wound, and plastic types of scalp closure are used whenever necessary No drain or pack is used in simple compound fractures

Compound fractures involving the paranasal sinuses are prepared and debrided similarly but drained by a Mosher copper wire cone drain, iodoform gauze and boric ointment gauze strips Patients with cerebrospinal fluid rhinorrhea are operated on by way of a Frazier type of right frontal flap

Chemotherapy with sulfanilamide or sulfadiazine is recommended by mouth and in the wound, but only as an adjunct to surgery Sulfathiazole should not be used in craniocerebral wounds

Without chemotherapy but with debridement done according to the described technic, the mortality in 130 patients was 9 2 per cent and the rate of postoperative sepsis 7 6 per cent

Hugh Cairns and H Holbourn[4] were able to examine the crash helmet and usually the patient in 106 cases of *head injuries in motorcyclists* Two main varieties of helmet are in use In one the outer shell is composed mainly of hard vulcanized rubber, and in the other of compressed wood pulp Apart from their composition, there are important differences of construction In the vulcanized type, the inner suspension system is connected to the outer shell by a stout cord at the base of the helmet, if the cord is broken there is nothing to prevent the rider's head from coming in contact with the crown of the outer shell In the pulp type the inner slings are stitched separately into the substance of the outer shell, and the stout cord at the base merely retains the hatband in place

The sites of the blow on the helmet and the injury to the underlying scalp and skull correspond Over 50 per cent of the blows are on the front of the helmet, the least common site of injury is the crown Blows on the

(4) Brit. M J 1 591 598 May 1 1943

is made by palpation through the wound, the first and only dressing prior to debridement must be one that can be applied with an absolute minimum of handling of the wound. Debridement should be complete except in certain special features, it must be done in a manner that avoids spreading of bacterial contamination throughout the wound and production of tissue necrosis, it should include removal of all large foreign bodies, no wound that has been properly debrided needs to or should be drained.

TECHNIC OF DEBRIDEMENT.—Under general anesthesia, the whole head is clipped and shaved, scrubbed for 10 minutes with soap and water, washed with alcohol and then ether, and the scalp painted with a 0.2 per cent alcoholic solution of iodine. The wound, which was closed by sterile gauze during this preparation, is cultured, often from several levels, and thoroughly swabbed inside with 7 per cent tincture of iodine. Two teams of assistants are used. One helps the surgeon do the debridement; the other inserts a cannula into an ankle vein and takes care of any emergencies. The line of incision is scratched on the scalp, drapes are put in place, the scalp and periosteal wound edges are excised en bloc and the used instruments are discarded. The bone is drilled in an uncontaminated area adjacent to the fracture line and the contaminated part of the fracture is cut loose, if possible in one piece, with a De Vilbiss rongeur. If the dura is intact and there is no reason to suspect subdural hematoma, it is not touched. If a clot is suspected, the dura is opened and the subdural space explored. Extradural hematomas are removed, and the source of the bleeding identified and closed. Tears in the venous sinuses are closed with muscle stamp grafts. If the dura is torn, its edges are excised, the tear being extended when necessary to expose properly the underlying cortex. Cortical lacerations and hematomas are removed by suction until all macerated brain tissue is excised. Bullet tracts are cleaned of bone fragments and debris and followed down to the bullet, which is removed. Intracortical hemostasis is attained by silver clips, the coagulating current or muscle stamp grafts. No irrigation of any kind is permitted. The dura is then closed over the cortical scar, making a relaxing incision laterally if necessary. Periosteum is used as a dural graft a few times, but fascia lata is not. The removed bone is not replaced.

The scalp is closed tightly with two layers of interrupted silk stitches—one in the galea and one in the skin. The skin

the long bones at time of infliction holds true also in compound fractures of the skull, except in fractures involving the paranasal sinuses and applies not only to hemolytic streptococci but also to meningococci and pneumococci Except for multiple small perforating wounds, with many fragments of foreign bodies scattered throughout the brain there is no reason to differentiate bullet wounds bacteriologically or therapeutically from other types of compound fractures of the skull This accords with recent experience with compound fractures of the long bones as cited by Trueta and others and supports the contention of Trueta and of Barnes that immobilization of the wound is the critical factor if immobilization means a "minimum of handling at the first dressing of the wound and until debridement is done There is no "golden six hour interval' in which surgery of compound fractures of any bone, whether long or flat must be practiced If contaminated tissues are manipulated, 30 minutes is too long to wait before dealing with the infection which has been created If contamination is recognized for what it is, infection can be prevented by proper debridement carried out any time within the first 48 hours, provided the patient is safely out of surgical shock and in a properly equipped and staffed hospital

Repair of Cranial Defects with Tantalum—The experiments of Robert H Pudenz[4] (M C, U S N R) on cats indicate that tantalum is a satisfactory alloplastic material for this purpose It has the desirable qualities of noncorrosiveness, inertness in tissue nonabsorbability, absence of toxic ingredients and malleability This last quality enables the surgeon to form the flat tantalum sheet to the desired contour at the operating table In view of these characters use of this metal should be considered in the repair of many of the cranial defects which will inevitably occur as the result of craniocerebral injury in the present war and particularly in those re

(4) J A M A 121 481 Feb 1 1943

occipital region are least dangerous and those on the temporal region most dangerous to life Blows on the crown may be associated with crush fractures of the vertebrae

In 40 per cent of the cases the head receives more than one blow

Brain injury rarely results from a blow limited to the face The crash helmet is effective in diminishing local damage to the brain and its coverings at the site of impact and tends to lower the incidence of cases of prolonged amnesia

Though the authors' figures are rather small, they suggest (1) that the incidence of fractures of the skull is quartered by the better (pulp) type of helmet and severity of those that do occur is less, (2) the incidence of prolonged amnesia (one day or more) is only one third of that in accidents in which no crash helmet is worn, (3) in nonlethal accidents the pulp crash helmet so alleviates the injury that one half of the dispatch riders who without its protection would have to go to hospital do not need to do so

Of the two types of crash helmet in common use the pulp helmet is superior to the vulcanized rubber helmet Further improvements in the design of helmets offer a profitable field of preventive medicine

Donald Munro[3] (Boston City Hosp) reports on 112 cultures from persons with compound fractures of the skull Fifty six were obtained from wounds in 52 cases Incidence of *infection in the wounds of* these *compound fractures of the skull* was 55 per cent during the first 24 hours, 66 per cent during the first 48 hours and 91 per cent after 48 hours

Pathogenic hemolytic streptococci were grown from wounds of only seven patients, in only one could contamination have occurred at injury Hare and Willits' contention that pathogenic hemolytic streptococci are not deposited in the wound of compound fracture of

(3) New England J M 227 944 Dec 17 1942

bandage will keep dressings neatly and firmly in place Scorah advocates use of the bandage in first aid and in preventing spread of pediculi in nurseries It is made in four sizes

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BRAIN AND MENINGES

Skull Fractures and Brain Injuries—In 15 years, Harry E Mock[7] (Chicago) has seen 495 skull fractures and over 1 500 head injuries without fracture Mortality for the former was 16 8 per cent, and combined with the latter, 11 per cent Reported mortality in other large series varies from 10 to 20 per cent Mock has conducted two surveys (1) of 3,156 consecutive cases (1929 1935) from about 50 hospitals and 100 surgeons regarding type of management and mortality, (2) of 3,106 cases (1935 1940), with more complete details regarding examination clinical course and type of treatment The data were graded and classified according to good, average or poor management Mortality for the three groups was, respectively, 17 21 23 29 and 30-42 per cent

Pathologic conditions which make death inevitable in 10 to 12 per cent are cerebral shock, massive brain lesions, small hemorrhages in vital centers, serious associated injuries and complication diseases Deaths from mismanagement, 5 50 per cent of which are preventable, are attributable to failure to treat shock first, failure to observe and "chart the course", hit and miss dehydration, overdehydration and starvation, too few or too late spinal punctures, too few, too many and too early operations, and oversedation That mortality rates may be improved by closer observation of the individual case and adherence to well established rules of management is shown by a 7 per cent improvement in the later survey

Management which will give improved results includes (1) treatment of cerebral shock first, (2) avoid

(7) J Indiana M A 36 1 10 January 1943

pairs in which good cosmetic result is most important

In this connection, O Hugh Fulcher[5] (M C, U S N R) presents a preliminary report on the case of a submarine fireman, 23, in which he used a *tantalum plate to repair a defect in the left frontal region* several centimeters above the orbit The plate was of 25 mil thickness and the defect measured 3×4 cm Convalescence was brief and the cosmetic result satisfactory The patient was completely rehabilitated two months after the operation was performed, and he was retained on active duty

Bonnet Bandage—The head bandage designed by J E Scorah [6] matron of the Borough Isolation Hospital,

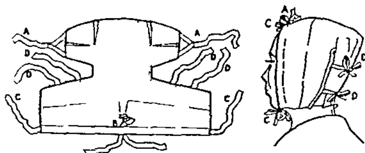


Fig 55

Derby, is economical capable of adjustment to fit any head, comfortable to wear and easy to launder At first sight the numerous tapes give an impression of unnecessary complexity, but they are all needed for nice adjustment and to prevent slipping The back tapes, *A*, are passed through the buttonhole *B* and tied above the forehead, the fixed strap of tape behind the buttonhole prevents the bow from slipping back through the hole and spoiling the close fit Tapes *D* are tied across the back of the head and tapes *C* under the chin The fit round the face is adjusted by tightening the free ends of tapes *C*, which come out above the forehead and thus act as a draw string The cap formed by the adjusted

( ) J A M A 1 1 931 933 Mar 20 1943
( ) 1 cet 1 ?J J 194?

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(7) J Indiana M A 36 1 10 January 1943

ance of adding insult to injury, (3) hourly charting of course, (4) transfusion for persistent shock or severe associated injuries (5) early oxygen administration for cerebral anoxia, threatened respiratory failure or associated chest injuries, (6) postural drainage or aspiration, (7) adequate dehydration, spinal drainage and operation, each when and if indicated by signs and symptoms, (8) avoidance of overdehydration, with spinal drainage early if indicated and withdrawal of adequate amount of fluid, (9) maintenance of nutrition, by stomach tube if necessary, (10) avoidance of over sedation using morphine seldom if ever, (11) consideration of patient alone, not of family or of surgeon's convenience

The operative rate in the good management group averaged 5 5 per cent as against 10 and 9 5 per cent in the average and poor management groups Highest operative rate in the good management group was 7 per cent as against 20 per cent in the poor management group Indications for operation are (1) markedly depressed skull fractures, simple and compound (2) extradural hemorrhage rarely apparent in first 24 hours, (3) subdural hemorrhage or subdural collection of fluid, both of which often give persistent late signs (4) subtemporal depression, rarely indicated in first 24 hours (5) occasional persistence of signs despite spinal drainage, requiring exploratory decompression

Mock stresses three operative principles (1) Operation is seldom indicated in the first 24 hours, except with a badly compounded skull fracture or a rare early progressive extradural hemorrhage for both of which operation can be delayed until cerebral shock is overcome (2) Many depressed skull fractures heal without operation, but all should be elevated after the patient's condition warrants, except when the fracture is only slightly depressed outside the rolandic area without signs or symptoms (3) Subtemporal decompression or bilateral exploration may become necessary when the patient fails

to respond to conservative measures, which should not be persisted in when signs and symptoms definitely indicate need for exploration

Incidence of skull fractures and brain injuries is increasing, and more cases are becoming the responsibility of the general physician and surgeon Over 50 per cent of deaths from brain injuries occur in the first 24 hours, and 60 per cent of these in the first 6 hours after the accident Thus all physicians should become expert in management of these conditions in order to reduce the high mortality

A Committee of Soviet Scientists[5] reports on *gas infection of the brain as one form of the serious complications of cerebrocranial injuries* Detailed bacteriologic examination revealed the same micro organisms in cerebrocranial injuries as in muscular injuries Sterile wounds were rare of 300 cases, only 2 were registered as sterile The infecting organisms were cocci in 61 7 per cent of the cases, putrefactive aerobes in 20 5 per cent, gas producing anaerobes in 11 2 per cent and putrefactive anaerobes in 6 2 per cent

The symptoms and signs of gas gangrene of the brain in all its forms depend on virulence of the anaerobe, type of trauma or crushing of cerebral tissue degree and depth of infected wound, disturbance of circulation, resistance of patient, etc Several of them are distinctive when compared with those of a similar infection of muscles prolapse of cerebral tissue, bursting headache meningitis and absence of crepitations Several cases of cerebral abscess of anaerobic origin have been described

Best results are obtained by active surgical intervention and use of anti gas gangrene serum The authors dealt boldly with excision of prolapsed brain tissue, gas infection and removal of necrotic tissue applying sulfanilamide and sulfathiazole emulsion to the cavity Orally sulfanilamide, 1 Gm, was given six times in 24 hours and intravenously 1 per cent solution of sulfathiazole

(5) Brit M J 1 785 788 June 6 1943

two or three times daily in doses of 30 to 40 cc in meningeal involvement, with 0 8 Gm sulfanilamide intrathecally The blood was watched carefully for signs of agranulocytosis When this occurred, blood transfusion was given, and the active sulfonamide therapy was not stopped But often the dose of the drug was reduced and, to lessen the toxic effects on the blood, transfusion of 250 to 350 cc blood was given, using anti gas gangrene serum simultaneously

Instructions should be issued to all front line dressing stations about the use of anti gas gangrene serums and local and oral sulfonamide therapy in contaminated penetrating cranial injuries, which are so often complicated by gas gangrene

Joseph H Siris[6] (New York City) reports five cases of *post traumatic focal epilepsy treated by encephalomyopexy* To effect actual vascular anastomosis between the cortex and overlying muscle in the absence of intracranial hypertension, intervening arachnoid must be eliminated Rather than strip it from the brain and thereby invite unfavorable hemorrhage, it was deemed preferable to accomplish the same result by lightly cauterizing the superficial portions of some of the more prominent exposed convolutions At such points, firm anastomosis with a superimposed muscle flap could then be expected to take place

The technical problem of swinging a pedicle flap of temporal muscle onto the cortex, without leaving a sizable bony defect is relatively simple The scalp and muscle flaps are reflected separately The underlying bone area is then removed en bloc When ready for closure, the bone flap is wired in place after a small opening has been made at its base The size of this defect is just sufficient to allow for the entry of muscle without constricting its pedicle

Three patients had not had recurrence of seizures five to seven months following operation In the remaining

(6) Surgery 13 653 660 May 1943

two, the frequency and intensity of paroxysms diminished appreciably but it is uncertain whether this improvement is to be attributed to operation Postoperative medication in all instances was maintained as close as possible to that which failed to control seizures preoperatively The operation was well tolerated No resulting impairment of function was observed Two patients who were hemiparetic prior to operation believed themselves to be stronger in the impaired limbs postoperatively This was not borne out by objective study

Of interest is the type of case which responded most favorably Those in which seizures did not recur shared the common denominator of focal manifestations corresponding to a macroscopic post traumatic cerebral lesion such as cystic degeneration In each instance the site of lesion and its extent were such as not to justify surgical removal without the expectation of possible resultant impairment of function and appreciable reformation of scar tissue The two cases in which convulsions recurred did not present comparable lesions at operation In one the brain appeared normal The pattern of the seizures furthermore was not focal In the other, the external appearance suggested slight atrophy and palpation indicated a possible intrinsic scar Although the seizures in this case were of a focal pattern, repeated electroencephalographic studies indicated a diffuse dysrhythmia over both hemispheres

Present data do not yet permit conclusions as to the efficacy of this procedure in selected cases of focal epilepsy They merely suggest that it may have some merit and indicate advisability of continued study

H Livingstone V Wellman, D Clark and V Lambros[7] (Univ of Chicago) report two cases of *so-called aseptic or chemical meningitis* following novocain spinal anesthesia and review eight additional cases following use of various spinal anesthetic agents described by other authors Four cases following simple lumbar puncture

(7) Surg Gynec & Obst 77:216 218 August, 1943

are reported which were taken from the literature

Prompt recovery occurred in the authors' cases after daily lumbar puncture and removal of spinal fluid In the eight cases which followed spinal anesthesia there were four recoveries and three deaths The outcome was unknown in one case In the four cases which followed simple lumbar puncture the patients recovered from their meningitic symptoms

Chemical meningitis is apparently an infrequent complication of spinal anesthesia, yet every surgeon and anesthetist should be cognizant of this rare complication and see that the correct diagnosis is made and adequate therapy instituted Apparently this hazard is so infrequent that it should not deter the experienced anesthetist from using this method of anesthesia when, after adequate consideration, it appears to be indicated

Electro Encephalograms of Monkeys Following Application of Microcrystalline Sulfonamides to the Brain —To study the effect of microcrystalline preparations of sulfanilamide, sulfapyridine, sulfadiazine and sulfathiazole applied to the surface of the uninjured cerebral cortex or injected into the injured brain of unanesthetized monkeys Herbert Jasper, William Cone, Robert Pudenz and Thomas Bennett[8] (McGill Univ) took electro encephalographic records from the surface of the dura or pia arachnoid The effect of intravenous administration of sodium salt of sulfathiazole on the electrical activity of the cortex was also studied in unanesthetized monkeys

Sulfathiazole applied directly to the cerebral cortex has a marked excitatory action causing local epileptiform discharge and convulsions which develop into severe generalized epileptic seizures Sodium sulfathiazole injected into the blood stream will produce epileptic convulsions only after concentration of unconjugated drug has exceeded 80 mg per cent with a total concentration of over 110 mg Definite excitatory effects may be ob

(8) Surg Gynec & Obst 6 599 611 May 1943

served in the electro encephalogram with blood levels ranging between one quarter and one half these amounts Sulfanilamide, sulfapyridine and sulfadiazine applied to the uninjured cortex cause no detectable change in its electrical activity or any clinical evidence of altered function Injected into the injured cortex, these drugs cause a slight transient depression of electrical activity or a transient increase in amount of slow wave activity following the injury, but no evidence of excitatory or epileptogenic action

A combination of sulfanilamide and sulfadiazine is suggested as the preparation of choice for topical application to the brain on the basis of relative solubility, antibacterial action and freedom from irritative action on cerebral tissue Sulfathiazole should not be used on the human brain

Perry P Volpitto and Wilford A Risteen[9] (Univ of Georgia) tried *stellate ganglion block in cerebral vascular occlusion* in a small series of patients Those in whom a diagnosis of cerebral thrombosis was made improved immediately or several hours after injection of procaine This improvement varied from partial to complete recovery One individual subject to frequent attacks of cerebral vasospasm, improved markedly immediately following the block

Four patients suspected of having brain hemorrhage were treated in a similar manner none evidenced improvement or aggravation of former symptoms

The cortex of two individuals was visualized while the stellate ganglion was being blocked with procaine An increase in the caliber of the ipsolateral pial vessels was noted immediately after injection Therefore it would be unwise to subject any patient suspected of brain hemorrhage to an injection of the stellate ganglion

Carl W Rand and David L Reeves[8] report 23 cases of *dermoid and epidermoid tumors (cholesteatomas) of the*

(9) Anesthesiology 4 403 408 July 1943
(8) Arch Surg 46 350 76 March 1943

central nervous system, 11 of which are instances of diploic or cranial epidermoid These cases were observed in the neurosurgical service or discovered at autopsy in the Los Angeles County General Hospital, or were studied in private practice

The tumors are uncommon, slowly growing neoplasms representing epiblastic inclusions of the dermal and epidermal layers The intracranial variety is seldom diagnosed preoperatively The extradural, or diploic type can be recognized roentgenographically

The diploic type is easily accessible surgically, and postoperative results are exceptionally good Sebaceous cysts of the scalp can be distinguished pathologically from epidermoid tumors by the absence of squamous epithelium and of keratohyaline granules and the presence of a secreting type of epithelium in the former The fact that such epidermoids are sometimes overlooked may be given as the reason that Mahoney was able to find only 23 diploic epidermoids in the series of 142 which he collected from the literature in 1936

Although complete extirpation of these tumors is necessary to prevent recurrence this often cannot be accomplished in the cases of intracranial epidermoids because of their extent and attachment to vital structures The epidermoids of the cerebellopontile angle show signs and symptoms similar to those of acoustic neurinomas with the exception that there seems to be a greater involvement of the cranial nerves on the affected side

The terms epidermoid and "dermoid" suggesting origin seem the most satisfactory The term 'cholesteatoma' is an unfortunate designation because it refers to a chemical by product which is neither an essential nor an invariable constituent of these tumors

FACE AND MOUTH

Treatment of Facial Fractures.—As soon as the patient's general condition permits, Wm Milton Adams[9] (Univ of Tennessee) takes him to the operating room and, while the facial wounds are being treated, replaces fluid loss by intravenous medication and, if necessary, transfusion of whole blood or blood plasma In most cases repair of the injuries may be carried out under a local anesthetic, by infiltration or nerve block If a general anesthetic is needed, sodium pentothal intravenously is used Lacerations often afford an approach for reduction and immobilization, particularly of fractures of the malar bone and orbital ridge In fracture of these bones without laceration when it is difficult to maintain fragments in proper position, a small incision is made in the region of the orbital rim to wire the fragments in place

The anterior wall of the antrum, if depressed, may be elevated with a curved instrument, such as a male urethral sound through an opening in the nasal wall beneath the inferior turbinate When the antrum is filled with blood and there is no history of sinus infection, no drainage is needed

Greenstick fractures of the maxilla after being reduced, frequently remain in place without mechanical support If the patient is edentulous and fracture is reduced to provide a normal external appearance, the base of the dentures can be built up to compensate for slight displacement However, when upper and lower teeth are present reduction must be accurate to permit perfect occlusion

For fixation of the maxilla, external fixation to a head cap is useful with infection which might contraindicate open reduction Although only partial immobilization is possible, satisfactory results can be obtained For

(9) J Tennessee M A 35 469 475 December 1942

two years, Adams has used open reduction and internal wire fixation Although in a few cases open reduction was delayed 7 10 days because of infection, it was felt that this delay was justifiable so that internal fixation might be carried out since it assures better end re



Fig 56 —Ext a ral appl a ce for f act es of maxilla when open reduction and wire fi ation are contra nd cated

sults, with complete immobilization The patient is also spared the discomfort of the headcap and readjustments are not necessary Minimal equipment is needed a pair of pliers small drill dissecting set and spool of small, stainless steel wire

Only two anatomic points of entrance are necessary for insertion of wires a small incision over the infra orbital ridge or at the lateral aspect of the supra orbital rim just above the zygomaticofrontal suture line

In a simple, complete bilateral fracture, infra orbital ridges are used as the points of fixation The maxilla is held in position with wires from upper teeth to infra orbital ridges Points of fixation should be lateral or medial to the infra-orbital foramen to prevent nerve pressure With associated fractures of the infra-orbital ridges and nasal bones enough fragments should be immobilized by separate wiring to the malar bone to maintain normal contour of the infra orbital ridge The nasal fractures may be handled as routine

With associated fractures of the malar bone higher point of fixation is needed the zygomatic process of the frontal bone serves the purpose Holes are drilled just above the fracture line and the wires are passed down behind the malar bone beneath the soft structures of the face and out the upper sulcus of the mouth After elevation of maxilla to its normal position, the wires are tied around the upper teeth With fracture of both upper and lower jaws, the maxilla is first immobilized to one or more of the unfractured bony parts above, after which the upper teeth may be used as the point of fixation for the mandible

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NECK

Ernest R Anderson[1] (Minneapolis) reports a case of *bilateral complete branchial fistulas*

Youth, 16, complained of discharge from two small openings on the front of the neck, present since infancy The mother stated that drops of milk would appear from each opening when he nursed No other particles of food had come from them There had never been soreness or swelling in the

(1) Minnesota Med 89 95 October 1942

neck On the anterior surface of the neck were two pinpoint openings, symmetrically placed at the anterior borders of the sternocleidomastoid muscle 1 in above the sternoclavicular articulation From each opening a thin, clear fluid drained A firm cordlike structure parallel to the anterior margin of the sternocleidomastoid muscle could be palpated in each anterior triangle of the neck from the opening to the angle of the mandible When the patient swallowed, each opening moved 1/4 in upward

Roentgenograms of the cervical region after injection of lipiodol into each opening showed that the sinus tracts passed superiorly from the external openings to the level of the base of the tongue on both sides, the tract on the right side being higher than that on the left No lipiodol passed into the pharynx On the operating table, each opening was injected with methylene blue solution which appeared in the pharynx on each side through a small opening on the posterior tonsillar pillar at junction of the superior and middle thirds

The fistulas were excised at a four month interval A purse string suture was placed around the external orifice and tied A cuff of skin was excised with the external orifice A longitudinal oblique incision was made over the fistulous tract from the external opening to below the angle of the mandible exposing the tract which was dissected from below upward and was located anteriorly and laterally to the carotid sheath At the level of the hyoid bone the tract angulated toward the pharynx It passed under the posterior belly of the digastric muscle and between the external and internal carotid arteries The glossopharyngeal, vagus and hypoglossal nerves were not visualized Dissection of the fistula was carried to the pharyngeal mucous membrane Inversion at the internal orifice was carried out according to the method of von Hacker The fistula was bisected leaving a 1/2 in segment attached to the pharyngeal mucous membrane A probe was passed through the internal orifice and fistula, the end of the fistula attached to the probe and the fistula inverted into the pharynx when the probe was withdrawn It was ligated flush with the mucous membrane The neck wound was sutured with interrupted sutures A Penrose drain was placed in the superior angle of the wound The patient recovered uneventfully and was discharged from the hospital each time on the fourth postoperative day There has been no recurrence

A branchial fistula bears a definite relationship to the main vascular and nervous structures of the neck if their development is normal A fistula originating from

the second branchial groove passes between the external and internal carotid arteries and in front of the vagus nerve One from the third groove goes behind the common or internal carotid arteries and in front of the vagus nerve One originating from the fourth branchial groove would have to go around the arch of the aorta on the left side and around the subclavian artery on the right side Frazer states that the only ones recognized with certainty are those from the second groove

Although branchial fistulas are congenital, few are found at birth Most of them appear before the age of 30, occurring with about equal frequency on either side of the neck, and about equally in males and females There seems to be some hereditary tendency

Branchial fistulas are complete, external incomplete and internal incomplete, the commonest being the external incomplete and the rarest the internal incomplete They are mostly unilateral The internal incomplete fistula is seldom found unless some complication occurs

The external opening is usually in the anterior triangle of the neck along a line running from the angle of the mandible to the sternoclavicular articulation In 80 per cent of cases the opening is in the lower third of the neck Atypical openings may represent internal incomplete fistulas that break through to the outside of the neck because of inflammatory changes The external opening is usually single, varying from pinpoint size to 2 or 3 mm diameter and usually smaller than the fistulous tract above it

Drainage on the neck is the usual complaint The discharge may be clear tenacious mucus or turbid white or yellow fluid In complete fistulas fluids or solids may pass from the pharynx to the outside of the neck

With fistulas involving the vagus nerve symptoms may be due to vagus irritation Usually there is inflammation A complete fistula shows some changes in the external orifice on deglutition The fistulous cord will create traction on the orifice and adjacent skin causing it

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the objective and subjective symptoms following extirpation of the tumor 26 months before death Eight months following operation, the subjective symptoms reappeared, and a year later the fibrocystic changes of the bone became progressively worse, despite roentgen irradiation to tumor and bone This was followed by a number of pathologic fractures Six weeks before death the serum phosphorus rose to 10 mg indicating renal decompensation

The essential postmortem findings were recurrent carcinoma of the parathyroid gland with metastasis to the peritracheal, subclavicular and perijugular lymph nodes, the lungs and the right kidney, generalized osteitis fibrosa cystica of the bones, bilateral nephrolithiasis bilateral chronic ascending pyelonephritis, left pyonephrosis with atrophy of the renal cortex and nephrocalcinosis

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THYROID

Six Years Experience of Thyroid Service at Massachusetts Memorial Hospitals—Hollis L Albright and Howard M Clute[2] (Boston) state that from January, 1936, through 1941, 334 thyroid operations were performed on 288 patients, with six deaths, only one occurring in the last three years Operative mortality was 1 8 per cent and patient mortality 2 1 per cent Ratio of females to males was 5 3 1 The youngest patient (exophthalmic goiter) was 15, and the oldest (carcinoma), 71 Since this is a general ward service, many seriously ill patients first appeared in advanced, untreated stages of thyroid disease, with dietary deficiencies and constitutional disease In treatment of such patients, experience has justified the relatively high rate of divided operations (31 per cent) in the 197 patients with hyper

( ) New England J Med 227 363 370 Sept 3 1942

to move upward or to retract, producing dimpling An indurated cord running up from the external opening can usually be palpated

Branchial fistulas must be differentiated from tuberculous adenitis with a sinus and from atypical thyroglossal duct fistula The latter is associated with the midportion of the hyoid bone, while a branchial fistula lies laterally to the bone

Treatment is total surgical extirpation of the tract, to avoid recurrence To get adequate exposure of the upper end of the fistula as it approaches the pharynx, the fascia covering the posterior belly of the digastric muscle may be incised in the long axis to free the muscle belly from its inner sheath The muscle can be retracted upward, producing a wider space to carry on the deep dissection and making it easier to identify vascular and nerve structures Contents must be considered contaminated, and spilling should be avoided Dissection should include the fistulous cord with all of the tract, accessory ducts or irregularities Injection of escharotics is condemned

Parathyroid Glands —*Carcinoma of the parathyroid gland* is rare Although a number of cases have been reported, the diagnosis is questionable because in some the blood chemistry and roentgen examinations have been incomplete or have failed to show the characteristic changes and in others no follow up has been submitted in the literature or examination of the bones at autopsy was incomplete

Karl A Meyer and Alex B Ragins[1] (Cook County Hosp) report the complete clinical course and autopsy findings in a case of diffuse fibrocystic disease of the bone due to carcinoma of the parathyroid gland, the patient s response to surgical and medical management having been reported previously

The patient showed only temporary improvement in

(1) Surgery 14 28 °95 August 1943

not be used until active plans for surgical treatment have been made Attempts to control hyperthyroidism with nonsurgical measures not only delay unjustifiably effective control of the disease but increase the likelihood of complications before and after thyroidectomy and thereby lessen the usual safety of the procedure The iodine fast patient with hyperthyroidism should disappear as soon as physicians recognize that surgery is a safe and rapid method for curing hyperthyroidism and that in outspoken thyroid toxicity iodine does not produce a cure

W C Sealy and H B Kernodle[3] state that most deaths following *thyroidectomy for hyperthyroidism* are due to thyroid crisis Measures directed toward prevention of these reactions will lower the postoperative mortality Careful preoperative management and *use of the two stage procedure* in patients who were poor risks reduced *the mortality at Duke Hospital from 6 94 to 1 7* per cent The short interval (10 12 days), two stage procedure is suggested as the best method for carrying out the two stage operation

A *new theory concerning the etiology of Riedel s struma* is offered by Joseph L De Courcy[4] (Cincinnati) The condition is a vascular rather than a glandular disease, the changes progressing from the outside of the gland rather than from within the organ It begins with a perithyroiditis, which induces constriction of the thyroid vessels and associated blood channels The tissues of the thyroid respond to this ischemia by formation of the ligneous tissue characteristic of Riedel's thyroiditis

(3) Ann Surg 117 ?63 267 February 1943
(4) Surgery 12 754 76 November 194?

thyroidism Despite this conservative approach, thyroid crisis developed in 16, 4 of whom died Therefore in a ward thyroid service one must take a longer time and give more detailed care in preoperative preparation of patients with hyperthyroidism to obtain the same low mortality figure as that among private patients

Morbidity and mortality rates have been considered constantly in the effort to improve results Although mortality of 1 7 per cent among patients with exophthalmic goiter conforms with results generally obtained, it is interesting that no patient died of this disease during the last three years

Mortality for adenomatous goiter with hyperthyroidism was 4 3 per cent Two deaths in the 40 cases were due to thyroid crisis Associated cardiovascular impairment was present in 23 per cent of these patients, and in only 13 per cent of the exophthalmic group These patients were on the average much older than the exophthalmic patients, and the goiter was of long standing There was no mortality in the 18 secondary operations for recurrent toxicity

Four permanent, unilateral recurrent laryngeal nerve injuries represent a rate of 1 2 per cent Three other patients sustained temporary nerve injury such as may result from undue traction, crushing or hemorrhage into the nerve area with recovery of function in 2 to 28 weeks Postoperative hypothyroidism and myxedema, noted in 12 of 288 patients, is far preferable to persisting toxicity and in certain thyrocardiac patients, is even desirable If necessary it is readily treated

Long continued use of iodine in the unoperated patient with hyperthyroidism was discouragingly frequent These patients were more difficult to prepare for surgery, operative risk was greater, postoperative reaction was less amenable to control and fatal outcome was more frequent Three patients (60 per cent of those who died in the hyperthyroid group) had been given iodine daily for one to six months before surgery Iodine should

TABLE 1—EFFECT OF EXTENT OF AXILLARY METASTASES ON SURVIVAL

	CASES	LIVING AND WELL 5 YR %	LIVING AND WELL 5 13 YR %	AV SURVIVAL OF THOSE DEAD OF DISEASE YR
No metastases to axillary lymph nodes	81	85	76	4 7
Metastases involving less than half the axillary lymph nodes	22	68	50	4 6
Metastases involving more than half the axillary lymph nodes	31	38	22	3 4
Metastases involving all axillary lymph nodes	37	19	16	2.2
Total with metastases to axillary lymph nodes	90	38	28	3
Total	171	60	50	3.3

TABLE 2—RELATION OF LYMPH NODE METASTASES TO RECURRENCES IN THE OPERATIVE SCAR

CASES	METASTASES TO AXILLARY LYMPH NODES %	RECURRENCES IN OPERATIVE SCAR %
81	0	7
22	under 50	9
31	over 50	19
37	100	21

Bilateral giant fibro adenoma of the breast developing during pregnancy is rare H Lester Reed and A E Hiebert[6] (Wichita, Kan) report a case in which rapid enormous growth and ulceration gave a false clinical impression of malignant change

Pregnant Negress 18, near term had large painful breasts Three years previously, she had noted a small firm mass in the upper quadrant of each breast No change occurred until onset of pregnancy, when the right breast became large and

(6) J Kansas M Soc 43 984 87 July 1942

Tumors —Tibor de Cholnoky[2] (New York City) made a study of *mammary cancer in youth* based on 73 cases in patients under 30, collected from the records of six hospitals, the careful follow up data make this study more valuable

Cancer of the breast in women under 30 accounts for 2 per cent of all mammary cancers Early diagnosis can be made with certainty only in the laboratory In small tumors less than 2 cm in diameter lymph nodes are infrequently involved and prognosis is favorable Five year survivals in the patients operated on were 40 8 per cent 10 year survivals 37 per cent Results of radical surgery in women under 30 are comparable to those obtained in the more advanced age groups The previously held belief that the prognosis for young women who have malignant tumors of the breast is fatal seems untenable

Shields Warren and Victor N Tompkins[7] (Boston) studied *significance of the extent of axillary metastases in carcinoma of the female breast* in 171 cases treated by radical mastectomy Curability as well as survival time of patients not cured decreases as the extent of metastases to the axillary lymph nodes increases (Table 1) Recurrence in the operative scar is more apt to occur as the extent of axillary involvement increases as demonstrated in Table 2

Patients with metastases to the axillary lymph nodes do not form a homogeneous group and there is prognostic value in further subdividing them With such subdivisions, study of cases is more accurate, even in small series and prognosis in a given case can be made with a little more assurance

(2) Surg Gynec & Obst 77 55 60 July 1943
(7) Ibid 76 327 330 March 194

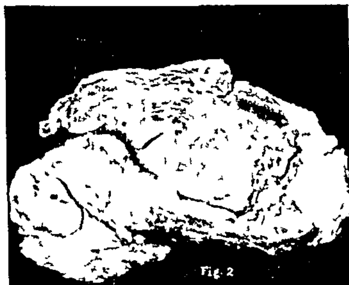


Fig 58 —Cross-section of right breast specimen one large necrotic encapsulated mass and one smaller and viable



Fig 59 —Cross-section of left brea t specimen two encapsulated tumors.

lumpy and later the left Some pain was present Both breasts continued to enlarge The right breast appeared four times normal expected size and was filled with many firm nodules not attached to the intact skin The left breast was twice normal size and consisted of one large, irregular, firm mass containing two smaller discrete masses Skin was intact The left axilla contained one firm movable, nontender mass, 2 cm. in diameter Diagnosis was bilateral fibro adenoma and mastitis Observation was elected until after delivery Three days after uneventful labor she was hospitalized with a slight fever and much local pain in the breasts which were little changed grossly Management included ice packs, sulfathiazole and narcotics For nine days the breasts remained unchanged, temperature was about 101 F and she left the hospital Ten days later swelling had increased bilaterally, the right breast had ulcerated and local pain had increased Examination revealed an ulcerated fungating mass on the right breast and the left breast under tension so that ulceration seemed imminent Malignant change was strongly suspected Simple mastectomy was performed under general anesthesia first on the right side and 11 days later on the left Postoperative course on each occasion was uneventful Follow up five months later showed no recurrence Microscopic examination of the specimens showed no definite malignant features and diagnosis was benign giant fibro adenoma with necrosis in lactating breast



Fig 67 —Giant right breast ulcerated

Fibro adenoma is often seen usually as a small to moderate sized single firm movable tumor in one breast of a young woman Pain is unusual, growth slow and malignant change rare Chronic cystic mastitis and cancer are not ordinarily confused with it The pearly white tumor can be easily shelled away from adjacent breast tissue is encapsulated and bulges on the cut section

tion of the epithelial as well as the connective tissue elements, and true fibrosarcoma, which contains fibroblasts alone

The reported case was one of fibrosarcoma without the presence of epithelial elements Therefore, the tumor probably arose from the interlobular or interlobar connective tissue This type of fibrosarcoma is suggested in the clinical history by the relatively short duration of the mass in the breast

Cartilage and bone are seen infrequently in tumors of the breast and occur in about 4 to 5 per cent of breast sarcomas They are found in all three subtypes of fibrosarcoma Except in the few cases which comply in all details with the definition of teratoma, the cartilage and bone arise by a process of metaplasia Seventy cases have been reported

The treatment of these tumors differs in no way from that of ordinary fibrosarcoma Distant metastases tend to occur late, and axillary lymph nodes which may be enlarged owing to secondary infection, are almost never involved by the tumor Since local recurrence is frequent, excision of the tumor alone is dangerous Most surgeons prefer simple mastectomy with or without removal of the pectoral muscles Some because of the difficulty of a definite preoperative diagnosis also do an axillary dissection

William Grant Cooper Jr and Lauren V Ackerman[4] (Columbia Mo) report three cases of *cystosarcoma phylloides* of the female breast one of which has metastasized to the axillary lymph nodes This tumor arises from the connective tissue of a pre existing mammary adenofibroma The clinical history usually obtained is that the patient in her four or fifth decade has been aware of a quiescent small hard breast nodule for many years with later growth to a huge size without associated constitutional symptoms On examination the breast is found tremendously enlarged and characteristically

(4) Surg Gynec & Obst 9 83 September 1943

The tumor appears rarely before the menarche and one appearing after the menopause is unusual Presence of an endocrine factor is apparent

The usual clinical course of the lesion is progressive for many years by slow enlargement, then by rapid growth rarely, if ever, with complete regression Occasionally the tumor is so large as to be termed giant fibro adenoma or less commonly and more properly, cystosarcoma phylloides

G A Carlucci and R F Wagner[3] describe a case of *osteochondrofibrosarcoma of the left breast*

In a Negress, 48 the tumor had started 18 months previously and had grown rapidly, with development of a large, foul smelling ulcer four weeks before admission The mass was irregularly nodular, of the consistency of firm sponge rubber and slightly tender on palpation A few small lymph nodes were felt in the left axilla The breast and the pectoral portion of the pectoralis major were removed In the region of the sixth costochondral junction was a small area where the tumor apparently infiltrated the chest wall Within three weeks there was evidence of local recurrence at this site The mass grew rapidly, and roentgenograms of the chest showed considerable spread in the lungs Despite an extensive course of radiotherapy the course was downhill and death occurred on the fifty second postoperative day

Classification of sarcoma of the breast was for many years in a hopeless muddle largely because of the rarity of these tumors In 1934 Fox presented a comprehensive classification based on histogenesis He divided the connective tissue of the breast into four types (1) intralobular—giving rise to intracanalicular fibro adenoma and cystosarcoma phylloides both benign and malignant (2) perilobular—giving rise to pericanalicular fibro adenoma and adenofibrosarcoma (3) interlobular and (4) interlobar—both giving rise to pure fibroma (extremely rare) and true fibrosarcoma

Thus there are three types of fibrosarcoma arising from the connective tissue of the breast cystosarcoma and adenofibrosarcoma in which there is active prolifera

(3) Am J Surg 61 1?6 August 1943

mass to underlying tissue, if present, would demonstrate muscle invasion Presence or absence of palpable axillary lymph nodes is not of significance as to their involvement in, or freedom from metastatic disease Most important, the fresh operating room specimen is softer and shows lobules which are less clearly outlined than those of the classic cystosarcoma phyllodes The surface is mucoid, without the dry and definite appearance of the more



Fig 60 (left) —Case 1 Note ulceration and frondlike projections
Fig 61 (right) —Case 2 Breast is drop shaped and nipple has been flattened

benign lesion Areas of fleshy tint with gelatinous zones and dark blue blotches of glairy hemorrhage suggest its more dangerous nature Muscle involvement makes this unequivocal A frozen section obtained at operation coupled with this gross appearance should lead to the correct diagnostic conclusion To avoid spillage of tumor cells extreme care must be used in obtaining the material for frozen section

ovoid The overlying skin and nipple are not invaded although local extension may have taken place to the adjacent structures Regional lymphadenopathy is not evident unless infection is superimposed Grossly, the tumor is found to contain frondlike pleats resembling a head of cauliflower, from which appearance it takes its name Microscopically, the unique finding is the increase in the fibrous elements The patients usually do well when treated by wide local excision, and the prognosis in general is good An occasional instance of pulmonary, osseous or extensive local spread with eventual fatality is mentioned

CASE 1—The patient presented a typical picture of cysto sarcoma phylloides She was in her sixth decade, and the breast fibroma had been present in the quiescent stage for 2½ years before rapid growth began 5 months prior to admission (Fig 60) No cause for onset of proliferation could be given The lymphadenopathy disappeared with removal of the inflammatory lesion, and the prognosis from wide local excision should be excellent

CASE 2—The patient presented the usual picture, with the exception of advanced age Examination revealed a 15 × 15 cm drop shaped mass in the breast without skin or muscle fixation (Fig 61) No lymphadenopathy was present Skeletal series was negative for pulmonary or osseous metastases Simple mammectomy was done, the postoperative course was uneventful (11 months), and no evidence of local or distant recurrence was found at the last clinic visit

The third case ran a different and more malignant course

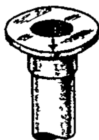
CASE 3—The original breast nodule was present for nine years without increase in size and for three years more with very slow growth A first removal was followed by local recurrence in 10 months, a second and more radical removal by recurrence in 6 months and a third and a fourth removal by wider and still more extensive recurrence in 3 and 2 months respectively Invasion of muscle and metastases to axillary lymph nodes were present There was no association of pregnancy or the menopause with the increased rate of growth

The malignant case differs from the usual one by a history of rapid growth or swift recurrence Examination of the patient is noncontributory but fixation of the

tubing slipped over the end of the rack serves as a union for a Record syringe, by this means the distal sac is inflated to form the occluding diaphragm

Saline is used to distend the sac, since accurate inflation cannot be attained with air The sac and tube are filled with saline before insertion all air being expelled by barbotage When in position, the sac is distended with a predetermined amount of saline and the rubber tube securely closed by a screw clip and the syringe removed

Two sizes of endotracheal tubes are required for adults—Magill sizes 10 and 8 Two bronchial occluders 40 and 36 cm long are also necessary In the longer occluder the first notch of the rack is 31 cm from the center of the distended diaphragm and in the shorter 27 cm Selection of catheter size and occluder length depends on sex and whether an upper or lower lobe or a whole lung is to be occluded A slightly different type of occluder is used when it is desired to close an upper lobe bronchus In general, structure is the same as the one described but the metal former is replaced by a small hollow metal tube 2 25 cm long and 1 25 cm in diameter to which the rubber sac is attached This tube with a beveled end to facilitate introduction is placed directly opposite the upper lobe bronchial orifice Lower lobe bronchi can then be ventilated through the lumen (Fig 62)



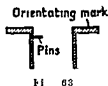


Fig 63

An essential principle in use of this occluder is that it be inserted so that the diaphragm is immediately above the bronchi to be shut off In case of the upper lobe bronchus the diaphragm must be opposite its orifice Exact placing of the occluder may be attained by blind introduction and by direct vision For the blind method it is necessary to know how far the bronchial orifices are from the teeth or nares Average measurements for a man are as follows (for a woman they are 2 cm less)

To control bronchial secretion in thoracic surgery, John Halton[8] (Liverpool) has devised an occluding diaphragm which permits blocking of the bronchial opening of one or more lobes

INSTRUMENT —The occluder is in two parts and consists of a wide bore Magill endotracheal tube and a mobile occluding unit (Fig 62) The nasal end of the tube has a flanged mount with an orienting mark that points to the concavity of the curve of the tube Two pins project a short distance into

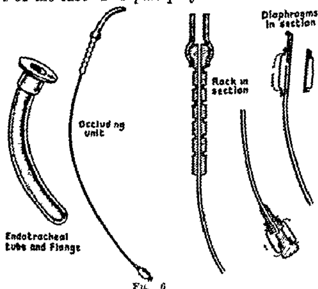


Fig. 6

the lumen of the mount and are designed to engage with a rack on the occluding unit (Fig 63) The occluding diaphragm consists of a fine stainless steel tube, curved in the same arc as the Magill tube At its distal end is mounted a hollow former 1 5 cm long and 0 33 cm in diameter, covered by a stout inflatable rubber sac the interior of which communicates directly with the lumen of the steel tube (Fig 62) Around the proximal or nasal end of the steel tube is a rack 8 cm long notched at 1 cm intervals (Fig 62) This rack engages with the pins fixed in the lumen of the flanged mount of the endotracheal tube A short length of rubber pressure

(8) Lancet 1 3? 14 Jan 1943

corresponding to the required distance can be engaged with pins of the flange Entrance to the right bronchus is effected by flexing the neck to the left and turning the flange to the right. When the occluder is in position, a 5 cc syringe filled with saline is attached to the rubber tube and the predetermined amount injected The tube is then securely clamped with a screw clip and the syringe removed At this stage, proof that the occluder is in correct position should always be obtained by listening to the chest The flange can now be secured with strapping and the anesthetic mask fitted to the face, with care that the protruding end of the occluder is housed safely in the dome of the mask At conclusion of the operation the patient is turned on the affected side, the screw clip loosened and saline allowed to escape The occluder is then withdrawn through the endotracheal tube or out of the trachea and any secretion which may have become lodged between the cut end of the bronchus and the occluding diaphragm is removed by a fine suction catheter down the endotracheal tube

VISUAL METHOD —The endotracheal tube is not needed The occluder alone is passed through the nose or mouth under direct laryngoscopic vision When in the trachea, the laryngoscope is exchanged for a bronchoscope The occluder is now advanced along the bronchoscope until it is in the desired position, then inflated, fixed in place and the bronchoscope withdrawn A plain Magill endotracheal catheter is inserted by the nasal or oral route and anesthesia can be proceeded with A special clip for fixing the occluder in position is being designed

[Occluding diaphragms are often useful but seldom necessary if in addition to bronchoscopic aspiration at the beginning of the operation and immediately afterwards tracheal suction is employed frequently through an endotracheal catheter during the operation —Ed]

R Stuppell[9] *improvised an artificial pneumothorax apparatus* from the standard Army pattern blood transfusion apparatus which may be temporarily dismantled and subsequently reassembled

APPARATUS —It consists essentially of two bottles connected so that water may be displaced from one to the other at will By this means it is possible to drive a known volume of air out of the second bottle through a rubber tube and suitable needle into the pleural space or air may be withdrawn from the pleural space into the bottle A water manometer is included in the system so that pressure changes may be observed Air tight connections are provided by rubber stoppers

(9) J Roy Army M Corps 78 163 165 April 1942

		Right Cm	Left Cm
Nares	to center of upper lobe bronchial orifice	30 75	34.25
Teeth		23 75	27.27
Nares	to center of middle lobe bronchial orifice	33 75	
Teeth		26 75	

These figures show sufficient margin between upper and middle lobes to allow for small individual variations Nevertheless it is advisable to check the measurements for each patient on iodized oil bronchograms Blind introduction of the occluder is impracticable in children If it is to be effective in closing off the lower bronchi and to leave the orifices above it patent, it must be placed at distances beyond those tabulated These measurements are as follows To occlude the right lower and middle lobes in the male, the occluder must lie 33 cm from the nares or 26 cm from the teeth To occlude the right lower lobe alone it is placed 35 cm from the nares, 28 cm from the teeth On the left the lower lobe is occluded 36 cm from the nares or 29 cm from the teeth Again 2 cm should be subtracted for the female patient

If a suitably curved tube is passed into the trachea, through either nose or mouth, and is placed so that its tip lies at the bifurcation of the trachea with the concavity of its curve facing directly forward further advancement with rotation through an angle of 45 degrees to the left or right will cause it to pass automatically into the left or right main bronchus This is possible even when pathologic changes have caused considerable distortion of the bronchial tree

Blind Technic —The patient is anesthetized and the endotracheal tube, with occluder inside it but not projecting beyond the beveled end is passed through the nose or mouth and advanced until the flange is close to nares or teeth If the instrument is to be passed into the left bronchus, the neck is flexed toward the right shoulder and the flange is turned through 45 degrees until the orienting arrow points to the left cheek The occluder is pushed down until the rack notch

One of the bottles is filled with a weak solution of dettol or other antiseptic, and the two bottles are connected by joining with a piece of rubber tubing each of the longer glass tubes If a little air is blown into the full bottle, a siphon action is started and fluid will flow from one bottle to another until the level is equal in both The manometer is half filled, i e, to the zero mark, with a watery solution of red ink which does not stain the glass

The apparatus may now be assembled by joining to the four way connection the manometer, bottle no 2, the intra pleural needle with its rubber tubing and the extra outlet to the atmosphere The air tightness of the connections should be tested by closing the spring clips at each outlet of the apparatus and opening the remaining two When one of the bottles is fastened on the hook on the manometer stand the fluid will rise in one of the limbs of the manometer and should remain stationary when the clip between the two bottles is closed

An ordinary serum needle does quite well for introducing air into the chest since in these surgical cases the lung is collapsed and is not likely to be injured by the sharp pointed needle

Chest Wall—*Tuberculous osteochondritis of costal cartilages and sternum* is relatively uncommon It is usually accompanied by evidence of the disease elsewhere in the body and follows pleural involvement with rupture externally Some cases arising from primary breast involvement have been reported A Hinson[1] (Rock Hill, S C) describes a case

Man, 43, noted swelling of the right side of the chest 19 years ago It was painless at first, but later became tender Two years later, it was incised and drained Several operations were done subsequently but the condition spread gradually until there were seven draining sinuses with much scarring over an area 4×8 in over the right costal cartilages and sternum Roentgen examination revealed widespread loss of bone detail of the body of the sternum and calcification of all costal cartilages Smears from the sinuses showed no tubercle bacilli

In four successive operations during the next 16 months, all the costal cartilages with contiguous parts of the ribs the sternum and part of the manubrium were excised A retrosternal abscess was found at the first operation, and the tuberculous nature of the disease was revealed by histologic examination The patient recovered

(1) South Med & Surg 104 659 660 December 194

for the bottles These stoppers, already bored with two holes, hold two glass tubes, the longer tube in each stopper must be replaced by a new one bent at a right angle to prevent any possible kinking of the rubber connection The long tube reaches to the bottom of the bottle, the short tube extends not more than ½ in within the neck

Each blood transfusion bottle is provided with a wire handle attached to its base by a metal band The latter is unclipped, and the wire handle is disengaged from it and turned inside out so that the hook at each end points out instead of in The handle is then attached to the neck of the bottle with a piece of string It serves to support the bottle on the hook on the manometer stand A strip of 1 in adhesive is stuck longitudinally on bottle no 2, which is graduated on the strapping at intervals of 50 cc

A four way connection is next prepared by joining with a short length of rubber tubing two glass Y connections, part of a Carrel Dakin apparatus The manometer is made by bending into a U shape a piece of glass tubing, about 80 cm long so that each limb of the U is about 40 cm long If this operation presents difficulties, an equally satisfactory manometer can be made by joining two straight tubes with a short length of rubber tubing The manometer is supported on a piece of board held upright by two struts as a base, all of which can be obtained from the side of a packing case A hook or nail is inserted into the side of the manometer stand at such a height as to allow fluid to flow from one bottle to another without causing the manometer to overflow The manometer is secured to the stand by strapping and is graduated in centimeters by ink marks on the board

To one of the limbs of the manometer is attached a piece of rubber tubing which is brought down behind the board and secured to the anterior extremity of one of the struts at the base If a short length of glass tubing is inserted at this point the remaining parts of the apparatus can be separated from the manometer for sterilization

Several lengths of rubber tubing are necessary, all of which should be of the same caliber as that of the glass manometer Finally four spring clips are needed to open or close the rubber connections as necessary when the apparatus is in operation One is attached to the rubber tube between the two bottles and a second between bottle no 2 and the four way connection a third closes off the rubber tube leading to the needle and a fourth that leading to the atmosphere A short length of glass tubing containing a small piece of sterile cotton wool to act as an air filter may be inserted near each outlet of the apparatus

bullet in the left posterior portion of the body of the eleventh dorsal vertebra Exploratory laparotomy disclosed only a 0 5 cm wound in the upper right lobe of the liver which was not bleeding About 6 Gm sulfanilamide was placed in the abdominal cavity and the incision closed without drainage The bullet wound was excised The patient had a smooth post operative course and received 54 Gm sulfadiazine in 19 days

On the sixth postoperative day a massive right sided accumulation of fluid developed in the chest, and on the seventh day the first thoracentesis was performed Culture of this fluid and of all subsequent specimens was negative The patient was put on a fat free, high protein diet, and 34 taps were done in 50 days with removal of 56,450 cc chylous fluid In 27 days, 16,800 cc of this fluid was injected intravenously

On the fifteenth day right phrenicotomy was performed without apparent decrease in the rate of accumulation of fluid From the sixteenth to the twenty ninth days the intravenous therapy was difficult to maintain because of phlebothrombosis of all extremities and the plasma proteins dropped steadily despite 1,500 cc blood plasma administered by hypodermoclysis On the twenty ninth day and thereafter, heparin was used as anticoagulant in the ratio of 4 mg per L chest fluid In the next five days it was possible to administer 7,000 cc fluid intravenously, and plasma proteins rose toward normal levels

As there was no apparent decrease in the rate of collection of chylous fluid in the chest it was decided to inject 50 cc sterile broth into the pleural cavity to stimulate a fibrinous reaction and thus seal off the leaking duct However, when an attempt was made to aspirate as much fluid as possible before injecting the broth, only 2,500 cc could be obtained Previous to this date over 3,500 cc had been withdrawn without development of respiratory embarrassment The broth was injected despite this sudden significant improvement Following this day, there was apparently complete cessation of leakage from the duct, and small amounts of fluid were aspirated to hasten re expansion of the lung The patient recovered completely

Despite absence of untoward reactions in this patient, it is probably wise to take special precautions when first reinjecting the chylous fluid A skin test with the fluid and slow injection of small amounts intravenously should probably be carried out It is also possible that the size of the fat droplets may be important in production of deleterious side effects

The multiplicity of operations proved that surgical attack on tuberculous osteochondritis of the sternum and costal cartilages must be radical The lesser procedures resulted in extension of the original foci However, to attempt such a radical extirpation in one stage would hardly be feasible, as it would probably result in a flabby chest wall Since the excisions were done in stages, the chest wall fibrosed sufficiently between operations to result in firm fixation The patient's chest wall feels as firm as it did before any of the cartilages were removed (Fig 64)



Fig 64 —Final result after excision of cartilages and most of sternum

Siler recently reported a total excision, in stages of all costal cartilages and the entire sternum, with recovery The condition in his case was due to acute costal chondritis following left subdiaphragmatic abscess complicating an operation for perforated peptic ulcer The excision was more extensive than in the present case as he removed the entire manubrium

Chylothorax—The literature contains only eight cases of chylothorax treated by intravenous injection of aspirated chest fluid three patients recovered, three died and two remained unchanged Edward Schnug and Joseph Ransohoff[5] (Univ of Cincinnati) report a case of *traumatic chylothorax successfully treated with intravenous chyle*

Negro 23 shot in the right midclavicular line between the fifth and sixth ribs, vomited and complained of severe abdominal pain and pain over the dorsal spine He had a large caliber

(5) Surgery 14 ° 8 81 August 1943

affords the best exposure and thereby facilitates careful dissection from other mediastinal structures, the anterior approach may be safer in the presence of infection Because of the malignant changes in at least 15 per cent of these tumors, early surgical removal is advised

[The editor agrees fully with the recommendation that these tumors should be removed as soon as diagnosed Nothing is gained by a course of watchful waiting The development of a communication with the lung greatly reduces the risk of surgical removal and after the tumor has become malignant the case becomes hopeless —Ed]

In the *treatment of chronic empyema*, P R Allison[7] uses a method which is less mutilating than many of the present procedures He reports three cases

TECHNIC —First, a simple rib resection is done and drainage operation with excision of the old drainage sinus, if necessary The cavity is washed out daily with Dakin's solution, and the amount of solution needed to fill the cavity serves as accurate measure of its size If the volume of the cavity remains constant over two or three weeks the second stage of the operation is done under general anesthesia supplemented by local injections of the intercostal spaces

An incision is made down to the ribs over the lowest part of the cavity, usually just above the drainage opening One, two or even three ribs are removed over the base of the cavity extending beyond its anterior and posterior limits for 1 or 2 in to provide a gap in which the bent finger can work An elongated oval piece of thickened parietal fibrous tissue is excised from the gap over the whole anteroposterior length of the cavity This will usually include one or two intercostal bundles, in which case the vessels are ligated and cut at each end of the wound and the intercostal nerves are divided separately, first at their posterior ends and then anteriorly A line of cleavage between the cut parietal fibrous layer and the rib is found and enlarged until the index finger can be inserted The flap is freely mobilized until it can be pressed down into even contact with the visceral layer of fibrous tissue over the whole extent of the cavity If the flap is so thick and the empyema cavity in part so narrow that the two surfaces cannot be accurately approximated the flap may be incised along its anterior or posterior attached margin, the incision being made at such an angle that a bevelled edge is produced allowing the now hinged flap to slide down into the cavity If no bron

(7) Lancet 1 3 234 Feb 0 1943

Use of heparin as anticoagulant in the fluid to be injected appears to be a valuable adjunct in the treatment of these patients

Injection of sterile broth or other fibrinogenic agents into the chest cavity may be of value in sealing off the leaking duct It is unfortunate that in this instance instillation of broth was carried out coincidently with the apparently spontaneous cessation of the leak

Neither diet nor phrenicotomy had any noticeable effect on the course of the disease It is impossible, how ever, to predict what would have been the outcome if these procedures had been omitted

[The use of heparin would seem to be a good suggestion in any case requiring frequent intravenous infusions —Ed]

Empyema —John M Dorsey[6] (Chicago) reports two cases of *chronic empyema due to dermoid tumors of the mediastinum* It is only by carefully planned study that diagnosis of the underlying cause of chronic thoracic sinuses can be correctly made Characteristically, der moids are found in the anterior mediastinum, extending laterally and posteriorly as they enlarge Study par ticularly of the lateral roentgenograms of the chest in the two cases shows the costovertebral gutter region to be free from disease This is usually involved in a chronic empyema process Lipiodol visualization of the sinus tracts demonstrates their extension into the anterior mediastinum This suggests the diagnosis of dermoid tumor which was further substantiated by obtaining material from the sinus which was characteristic of these lesions such as hair and sebaceous material At operation in each instance a tumor was removed Hair was seen on both specimens The derivatives of ectoderm and mesoderm were found on microscopic section

The surgical approach to each patient must be in dividualized While the transpleural operation through a posterolateral incision as advocated by Harrington

(6) Surgery 13 755 761 May 194

affords the best exposure and thereby facilitates careful dissection from other mediastinal structures, the anterior approach may be safer in the presence of infection Because of the malignant changes in at least 15 per cent of these tumors, early surgical removal is advised

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(7) Lancet 1 39 34 Feb 0 1943

chial fistulas are present the fibrous covering of the lung may be carefully incised in chessboard fashion but it is better not to do this than to injure the underlying lung

The mobilized parietal flap is pressed down on to the lung and held in place by packing the cavity between it and the ribs with dry gauze into which sulfanilamide powder has been rubbed This packing must be so tight that it produces uniform approximation of the two layers The wound in the chest wall is lightly packed and a firm elastoplast dressing is applied

Ten days after operation, the pack is removed under gas and oxygen anesthesia The parietal flap is firmly adherent to the lung, and the extrapleural space clean and healthy Any bronchial fistulas which were present are now sealed The cavity is washed out once or twice daily and a light gauze pack wrung out in Dakin's solution inserted If healing takes place anteroposteriorly more quickly than from above downward, it may be necessary in the later stages to insert a tube to keep the drainage free

[If there is much fibrosis of the lung it is difficult to understand how the extrapleural space will become obliterated —Ed.]

Fatal Borate Poisoning —Charles A Ross and John F Conway[8] (Galesburg Ill) report a case resulting from continuous irrigation of an empyema cavity with saturated boric acid solution A review of clinical and experimental literature on borate poisoning seems to indicate that boric acid and its related compounds are more dangerous as irrigants and local medicaments than is commonly assumed

Cysts of Lung —*Solitary cysts or cystlike structures of pulmonary origin* usually come up for treatment because of some accident to the cyst M Dawson Tyson[9] (Hanover, N H) observed seven cases One was symptomless, but the other six showed nearly as many types of complications as there were cases These complications were infection of the cyst without rupture infection of the cyst with rupture and formation of pyopneumothorax, progressive expansion of the cyst after subsidence of infection rupture of the cyst without infection but with the presence of a ball valve and formation of a

(8) Am J Surg 60 386 395 June 1943
(9) Ann Surg 118 50 75 July 1943

tension pneumothorax, and rupture of the cyst with discharge of sterile fluid into the pleural cavity All six patients were operated on successfully

Four of the cases almost surely represented congenital cysts of pulmonary origin, two of them being cystic accessory lobes arising outside the normal lung tissue The other two probably were not congenital cysts, since one resembled an emphysematous bulla more closely than a true cyst and the other was probably originally a lung abscess, though certain findings militated against this conclusion

Extirpation of the lesion, when possible, seems the best treatment If the lesion has an epithelial lining collapse or simple drainage will not cause permanent closure of the cavity The scope of the operation may vary from simple excision or enucleation of the lesion, as in three of the reported cases, to lobectomy or even total pneumonectomy

Elimination of infection in the cavity as far as possible is an important preoperative requirement With a bronchial communication, postural drainage may accomplish this goal, but external drainage may be required in closed cysts or when the communicating bronchus is inadequate Avoidance of opening the cyst during removal is desirable, but not always possible To remove the cyst intact, careful dissection and individual ligation of the hilar structures may be necessary This technic was used successfully in one of the cases and, if it had been used in another instead of the tourniquet method, opening of the cyst and possibly the following empyema might have been avoided

The question of drainage after cyst removal is an individual problem that has to be settled at the time, but it is a safe maxim that if the cyst has been opened during removal drainage should be instituted Postoperative care is the same as after other open chest operations in which lung tissue has been manipulated or resected

Symptomless cysts are uncommon and even silent

solitary cystic lesions should be removed if possible

[This condition formerly thought to be rare is now recognized as being fairly common The danger of infection is always great and when these cysts become infected they rarely if ever become healed Therefore extirpation before infection is advisable It is probably significant that it is relatively uncommon to recognize congenital cystic disease in patients of middle age or beyond, because this fact probably indicates that most patients with the condition die before they reach middle age —Ed]

Echinococcus Cyst of Lung —Clifford D Benson, William A Evans Jr, and Wolf W Zuelzer[2] (Detroit) report successful surgical excision of an echinococcus



Fig 65 (left) —Post o anterio projection showing large ovoid mass of l latid esi le separated f om capsule of adventitia by a crescent c air spa e super rly and to a lesser extent inferiorly
Fig 66 (right) —Same ca e Right lateral projection

cyst of the lung by a single stage procedure in a boy, 12 The roentgen manifestation due to presence of air between the parasite and the adventitia, regarded as a pathognomonic sign by South American authors, was present (Figs 65 and 66), and the small bronchial

(2) Ann. Surg 117 68 77 February 1943

fistula accounting for the phenomenon was demonstrated at operation Recognition of this roentgen sign will lead to early diagnosis of hydatid cyst of the lung and followed by surgical excision of the cyst intact, will eliminate complications due to rupture of the cyst and multiple stage operations to cure the disease

Howard H Bradshaw and James F O'Neill[1] (Winston Salem, N C) report the results of *surgical treatment of bronchiectasis in 76 patients* whose disorder was mostly due to an unknown etiologic agent

The complication which most often leads to death after lobectomy is infection Since operation is usually done as an elective procedure time should be taken to get these patients in the best possible physical condition

Endotracheal oxygen ether anesthesia was used in most cases It would be ideal to ligate individually the vessels and the bronchus of the hilus of the lobe Unfortunately, this is not always possible, but it is often feasible to ligate the inferior pulmonary vein to the lobe, divide it and then apply a lobe tourniquet This manipulation aids considerably in production of a short stump

Many clamps have been devised to control hemorrhage during separation of the lobes but none is satisfactory It is fairly efficient to start two running lock stitch sutures of fine chromicized gut to control the hemorrhage as formation of the fissure begins If the sutures keep pace with the dissection little blood is lost Mattress sutures of fine silk can be used to bring pleural surfaces together over the raw area of the lobes Since the advent of sulfanilamide there is an occasional patient who does not need drainage The period of hospitalization is shortened by weeks if drainage is not required

In a report on this disease the nature and extent of the disorder should be clearly indicated With the high mortality known to occur in untreated patients (35 per cent) and the chronic invalidism present in those who do

(1) Surg Gynec & Obst 7 315 318 September 1943

not die, it is logical to broaden the indications for operation as much as possible, thus the authors have refused to operate only on elderly patients with bilateral disease

In the authors' series, one death occurred among the 24 patients with lower lobe or lower lobe and lingula disease, a mortality of 4 2 per cent, all obviously diseased lung tissue was removed Among 26 patients in whom one lobe was removed but disease was present in other lobes, there were four deaths, a mortality of 15 4 per cent Seventeen patients had two or more lobes removed with three deaths a mortality of 18 per cent, 11 had disease in other lobes Pneumonectomy was performed in nine patients with four deaths, a mortality of 44 per cent, disease was present in the remaining lung in all those who died

Consequently, with minimal disease that can be completely removed results are excellent If disease is present in many lobes, the most diseased lobe can be removed with relative safety, but the mortality is probably three to four times as great as in single lobe and lingula disease Multiple lobes can be removed in the presence of disease in remaining lobes with only slightly greater mortality than in single lobe removals in the presence of disease in some of the remaining lobes Pneumonectomy can be safely done if the disease is limited to the side that is removed In this series, when a lobe is called diseased it means that there is definite evidence of bronchiectasis by iodized oil studies

Tumors—Howard P Doub and Horace C Jones[2] (Henry Ford Hosp) discuss *endothelioma of the pleura* The clinical picture is usually inconclusive In the earliest stage when involvement of the pleura is slight there may be few or no symptoms Some patients complain of severe pleural pain and elevation of temperature Dyspnea on exertion is common When fluid develops

(2) Radiology 39 27 32 July 194°

it simulates an inflammatory effusion Anemia is sometimes present but is of little diagnostic aid Fever of varying degree and regularity may occur and is probably of toxic origin Wessler and Jaches state that there is marked contrast between the inordinate size of pleural tumors, especially the endotheliomas and the paucity of symptoms which they produce A patient with no symptoms other than some dyspnea and possibly fever may show extensive roentgen changes over one side of the chest

The authors report three fairly typical cases The illness, as a rule, dates from a cold or acute infection from which the patient does not return to normal well being Examination usually shows evidence of fluid in the pleural cavity There may be palpable lymph nodes but this is not common When the fluid is removed, it reaccumulates rapidly, and this cycle may recur many times until the examiner becomes suspicious of a malignant growth Microscopic examination of the removed fluid may reveal tumor cells, as in two of the reported cases

Roentgen examination showed evidence of fluid in the three cases, but did not reveal the etiologic factor In two cases air was introduced to replace the removed fluid and clearly outlined the tumor nodules This is a useful diagnostic procedure which should be used more often

The fact that autopsy in most of these cases fails to reveal evidence of any tumor in the lung itself is against the theory of a metastatic origin from bronchiogenic cancer There is more evidence that the tumors develop from the endothelial cells of the lymph spaces or pleural surfaces

The often repeated statement that the clinician must be cancer minded holds true in the diagnosis of these cases The patients are often under observation for considerable periods before the true diagnosis is apparent Rapid reaccumulation of fluid, in the absence of pulmonary infiltration in the apexes indicates further study

of the underlying lung to rule out a lesion in this area If the fluid is blood tinged the probability of tumor is heightened Cases have been reported in which turbid infected fluid has been removed This may lead the clinician astray Bronchoscopy has been recommended, but it is difficult to see how this could be helpful, as the bronchi cannot be explored to the vicinity of the lesion

Malignant tumors of the lung in women are uncommon, but benign or vascular tumors are sometimes observed Mario M Brea and Flavio Niño[3] (Univ of Buenos Aires) describe a case of *hemangio endothelioma of the right lung* They discuss the difficulties encountered in determining the mediastinal or pulmonary localization of the tumor and its benign or malignant nature and note the diagnostic value of female sex, long evolution without local or distant invasion frequent expectoration of blood and spherical roentgen image

Woman, 47, presented clinical and roentgen symptoms found by other authors in similar cases Excision of the upper and middle lobes was performed, but the postoperative course was complicated by atelectasis of the remaining lobe and the patient died of acute pleuropulmonary tuberculosis two months later

The postoperative atelectasis of the lower lobe was caused by the massive suture of the lobar pedicle close to the intermediate bronchus because of the concomitant resection of the middle lobe the atelectasis was obstructive, as the lower lobe adhered to the thoracic wall The miliary tuberculosis of the lung certainly resulted from the surgical traumatism to the pleura, the adhesions of which were present before operation and must have been the result of a previous tuberculous pleuritis that had developed silently The surgical liberation of the lobe through the diseased pleura served as starting point for the tuberculous generalization this also explains the tuberculosis of the parietal pleura revealed by biopsy

The meaning of extensive pleural adhesions in patients with nontuberculous pulmonary lesions who must undergo endothoracic operations must be kept in mind because the surgical trauma may release complications

(3) Medicina Buenos Aires 3 909 90 January 1943

difficult to interpret if the pleural lesion is attributed to the actual disease and not to an old tuberculosis

[The tumor was apparently recognized as a malignant one The operation of total pneumonectomy should therefore have been performed instead of a partial resection If the whole lung had been removed the complication which caused the patient's death could not have occurred In an experience of over 500 cases of pulmonary tumors the editor has never seen one which he would diagnose a a hemangio endothelioma Probably this case was an example of what we prefer to designate a "mixed tumor of the bronchus —Ed]

Harry Hauser[4] (Western Reserve Univ) states that primary *cancer of the lung in infancy* is rare, only three cases having been reported It is also relatively rare in childhood and early adulthood, as only 11 cases are found in the literature Hauser reports a case in a Negro baby, aged 17 months

The child had been ill for five months, and no suspicion of the true nature of the disease was entertained On the basis of a diagnosis of whooping cough, she was sent to the contagious ward of a hospital, where bronchopneumonia was diagnosed Had a chest roentgenogram been taken at that time, there might have been enough evidence to suggest the presence of a new growth Although even later when the lesion was well advanced the roentgen findings were interpreted as due to pleural fluid The real clue to diagnosis came when attempts to aspirate the left pleural cavity proved ineffective The small amount of serosanguineous material together with a few fragments of tissue, indicated that the lesion might be neoplastic The possibility of a primary pleural tumor or a tumor of the lymphoid series was at first entertained The patient's gradually retrogressive condition precluded any type of therapy which might have aided in the differential diagnosis Not until autopsy was performed was a primary lung tumor considered At first the gross diagnosis was primary sarcoma of the lung after the microscopic features were analyzed, the final diagnosis was primary small cell pulmonary carcinoma

This case demonstrates that a neoplasm may produce the same appearance as a large collection of fluid, provided the tumor is of sufficient size to cause displacement of the mediastinal structures (Fig 67) In several of the cases reported in the literature the roentgen ap

(4) Radiology 39 33 38 July 1942

pearance was similar to that in the case reported here and in several instances the erroneous diagnosis of pleural effusion was made instead of a diagnosis of neoplasm Thus, it seems obvious that a diagnosis of primary bronchogenic carcinoma must always be considered in the differential roentgen diagnosis of large, dense, homogeneous shadows involving one side of the chest

It seems more probable that primary bronchogenic cancer in infancy develops on a congenital basis rather

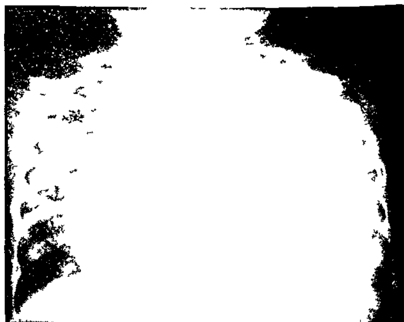


Fig 67 —Ante posterior roentgenogram showing dense homogeneous shadow occupying entire left hemithorax trachea and heart considerably displaced to right

than on an acquired one Avitaminosis A and influenzal infections may be factors in the production of metaplasia of bronchial epithelium with subsequent development of cancer The logical treatment of cancer of the lung in the young is surgical extirpation when the lesion is small and situated peripherally It is possible that palliation may be obtained by high voltage roentgen therapy in the later stages of the disease

Bruno W. Volk, William Johnson and B. I. Malstrom[4] (Galesburg) report an *unusual case of primary carcinoma of the lung* in which the only complaints were increasing dyspnea without exertion, frequent attacks of slight pains in both sides of the chest and progressive fatigue. Temperature was normal, pulse 130 and respirations up to 36. Blood examination revealed increase of polymorphonuclear leukocytes to 16,000 but the differential count was normal. Roentgen films of the chest were interpreted as showing miliary tuberculosis of both lungs. The patient deteriorated rapidly and died two weeks after appearance of symptoms. Diagnosis of miliary carcinoma of the lungs was made after death.

Primary carcinoma of the lung produces no signs or symptoms in about 15 per cent of all cases. Therefore it is not surprising that this patient felt well until about two weeks before his death. This case, however, is of interest because of the peculiar miliary distribution of the tumor throughout both lungs, simulating miliary tuberculosis. At autopsy the possibility of miliary tuberculosis could not be ruled out by gross examination, as the distribution and appearance of the small nodules were absolutely uncharacteristic for pulmonary carcinoma.

Nodular involvement of the lungs in primary carcinoma is comparatively rare. Miliary carcinoma or carcinosis is probably the result of local metastases. Compared to miliary tuberculosis the carcinomatous nodules are larger, whiter, more translucent and situated along the lymph channels. Although the tiny carcinomatous nodules of the present case were scattered more or less homogeneously throughout both lungs, the density of their arrangement increased in the base of the right upper lobe. Possibly the primary tumor started in this area.

The morphologic similarity to miliary tuberculosis which deceived the roentgenologist was remarkable and

(4) Illinois M. J. 8[illegible] 461 [illegible]mber 194[illegible]

the explanation of his error was obvious after the gross examination of the lungs had been made

The histologic examination left no doubt as to the character of the tumor The peculiar distribution of the growth was due to its spread through the perivascular or peribronchial lymphatics which were filled with tumor cells Pleomorphism of the cells is not unusual, as the different sections of a single tumor often contain cells and cellular arrangements of the most varied types In pulmonary carcinoma the presence of mucus is usually associated with that of more differentiated cubical or columnar cells, arranged around glandlike spaces, which point to the origin of the tumor cells from the mucus producing epithelial cells The present case showed no gland formation, the carcinoma was composed of undifferentiated, polyhedral cells mingled with cylindric epithelium and large cells containing mucin It is rare that a carcinoma preserves the potency of cellular secretion, while completely losing the tendency for glandular structure The peculiar gross appearance of the individual carcinomatous nodules has to be attributed to the production of a rather large quantity of mucus The miliary type of primary pulmonary carcinoma was described before (Ewing Boyd), however, the presence of mucin in the undifferentiated type of carcinoma of the lung is remarkable as no other similar cases are found in the literature

To determine the *value of sputum examination in diagnosis of carcinoma of the lung,* F J Sambrook Gowar[6] (London) studied 93 suspected cases by Dudgeon's wet smear method Malignant cells could be demonstrated in the sputum of 64 3 per cent of cases of proved or probable carcinomas It was not only in advanced cases that such cells were found, as the growth was operable in a significant proportion of cases

The test is of value in establishing diagnosis of malig

(6) Brit J Surg 30 193 00 January 1943

nancy when other methods of investigation, including bronchoscopy, have failed and when it it is not desired to explore the chest, when the patient is too ill to be submitted to other methods of investigation and when the growth is masked by secondary inflammatory changes in the lung The test should be used more widely, for it may lead to earlier diagnosis in some cases

Aspiration biopsy as a method of diagnosis should be reserved for cases giving repeatedly negative sputum tests and should not be used when surgical removal of the growth is envisaged

Histologic Analogy of Bronchial Adenoma to Late Prenatal and Early Postnatal Structures—Recently emphasis has been placed on noncancerous tumors of the bronchial tree, adenoma being the most important on the basis of incidence alone Several theories of origin have been suggested In all histologic discussions, vascularity of these tumors is emphasized Individual cells are usually said to have small, round, darkly staining nuclei with scant cytoplasm It has also been noted that a mistaken diagnosis of endothelioma might readily be made and attention has been called to resemblance of the tumor cells to lymphocytes However, other forms show a histologic structure with a secretory gland appearance while in still others there is a definite mixture of the two types of cells Thus it seems that there are two possible elements mesodermal, showing especially cells resembling lymphoid tissue with varying proportions of blood vascular elements, and endodermal showing glandular cells resembling the glandular and ductal epithelium of bronchial mucous glands This is in accord with the work of Womack and Graham and would support their use of the term "mixed tumors"

Since mention had been made of the possibility that adenoma is related to embryonic and fetal tissues, William H Harris, Jr[3] (Tulane Univ) studied his material

(3) Arch Path 35 85 92 January 1943

from this point of view It consisted of fetuses ranging in age from 7 months to maturity and infants who died from a few hours to three months after birth (23 in all) In each instance a transverse section through the trachea and surrounding structures, just above the bifurcation was prepared A similar section was obtained through the region of the stem bronchi approximately 1 cm beyond their origin These areas were selected because they represent the predominant sites of such neoplasms

Duplication of findings was consistent in all the age periods

Stem Bronchi—Salient features in these specimens were character and location of secretory glands The bronchial epithelium at these stages, while of columnar ciliated type is delicate easily disturbed and somewhat pale in tinctorial property Lining epithelium of the glandular acini is at variance with the usual regulated orderly arrangement of more or less pyramidal cell type present after the third month Cell membranes are poorly formed, cell outline is ragged and cells are distributed rather haphazardly within the limiting basement membrane (Fig 68) Occasionally a more immature gland is noted in which merely formative cells are aggregated This same general aspect of poorly developed glandular elements has been noted in a bronchiogenic tumor (Fig 69) Such glandular patterns form a distinct contrast to those noted after maturation (Fig 70) or in a simple bronchial glandular polyp in which proper configuration of cells and arrangement are present

Lymphoid and Vascular Structures—Vascular structures of the bronchi consist of numerous thin walled blood vessels in which mural development is greatly restricted They appear more like blood sinuses are of various sizes and distributed mostly in the submucosa These characters are greatly exaggerated in the closely approximated and often contiguous lymphoid tissue Not only are such blood sinuses numerous and diffusely scattered

throughout, but the blood cells and lymphoid cells may be intimately dispersed without evidence of mural separation The stroma of these immature lymphoid glands is slight and irregularly arranged Furthermore, there is no cortical and medullary differentiation or nodule *formation* Germinal centers *have not developed at such* stages These structures are contiguous to the outer structure of the main stem bronchi and may protrude into their walls This feature is emphasized in that



Fig 78—Bronchial mucous glands of newborn infant showing rather ill-defined cell membranes and somewhat haphazard arrangement of acini within limiting basement membrane

bronchiogenic adenoma may closely simulate the cellular pattern and vascularity of such lymphoid developments In the tumor formation however, a delicate stromal structure is often arranged in acinal compartments

These observations show the similarity of infantile types of structures, especially the bronchial mucous glands and peribronchial and peritracheal lymphadenoid tissue to the histologic findings in bronchial adenoma Since the bronchial mucous glands occurred not only

just beneath the mucosa but more deeply between the cartilaginous rings and since the lymphadenoid tissue was found not only peribronchially and peritracheally but in the walls of bronchi and trachea, it can be deduced that tumors arising from such tissues may be intra or extramural or may extend into the bronchial or the tracheal lumen Such locations for bronchial adenomas have been described by Goldman Adenomatous tumors have been found to occur in early life and often have their inception in the first decade The potentiality of these immature histologic structures for originating or assuming cancerous characters is conceivable

The general term "adenoma" does not seem technically correct for all these tumors, some being predominantly lymphoid Likewise, since all are not of both lymphoid and secretory gland structure, the term "mixed tumor" is not always applicable Perhaps an added suffix such as "secretory type," "lymphoid or angiolymphoid type" or "mixed type," would make the appellation of adenoma more comprehensive

Pneumonectomy—Sol Roy Rosenthal, Willard Van Hazel and Carl Ireneus Jr [7] (Univ of Illinois) used a *silver plug as a method of bronchial closure in total left pneumonectomy* in 27 normal dogs There were three postoperative deaths due to coughing up of the plug within two weeks These deaths occurred early in the study because plugs of correct size were not available and those used were too small There were no fatalities in the last 10 animals

In the 24 surviving dogs the plug was removed bronchoscopically at intervals varying from 14 to over 300 days after operation The animals were killed at different periods after removal of the plug to note results The distal end of the bronchus seen through the bronchoscope after removal of the plug and through the pleural cavity at autopsy appeared healed and showed no sign

(7) Surgery 13 880 888 June 1943

of infection The usual test for bronchopleural fistula was entirely negative Microscopic sections verified the solidarity of healing and absence of infection Healing occurred at the line of suture in the distal end of the bronchus The healed end was conical in most animals

Two dogs died 34 and 21 days after removal of the plug from an infected wound The bronchial stump was well healed and showed no sign of infection

Julian Johnson[5] (Univ of Pennsylvania) reports 20 cases in which *total pneumonectomy* was performed with only one death a mortality of 5 per cent Thirteen of the patients were operated on for carcinoma, six for bronchiectasis and one for multiple lung abscesses The low average age of the patients was undoubtedly a major factor in the low operative mortality Nevertheless, this group demonstrates that total pneumonectomy is relatively safe in the patient without complicating diseases

The only hope of cure for the patient with bronchogenic carcinoma is surgical removal of the tumor, which usually means total pneumonectomy This operation also offers a complete cure for the patient with extensive but unilateral suppurative disease of the lung The mortality in the young patient should be low whether the operation is for carcinoma or for suppurative disease The mortality will probably remain fairly high in the elderly patient with carcinoma associated with other complicating diseases

[This is an exceptionally low mortality rate for total pneumonectomy and probably will not be sustained in a larger series of cases Operative mortality in this kind of case as in other types of surgery is largely dependent on the condition of the patient Young subjects with good cardiovascular systems and free from much intoxication from infection will undergo the removal of a lung with little risk On the other hand the more one tries to extend the application of the operation to give a chance for cure to the doubtful risk patient the greater will be the operative mortality In this respect the factor of age is undoubtedly important In the editor s experience of 102 total pneumonectomies the oldest patient

(5) Surg Gyn & Obst 460 468 April 1943

to urine the operation was 68 Another patient 70 years old did well for a week and then died suddenly of acute myocardial failure —Ed]

Closure of Bronchus Following Total Pneumonectomy —William F Rienhoff Jr James Gannon, Jr, and Irwin Sherman[6] (Johns Hopkins Univ) found from

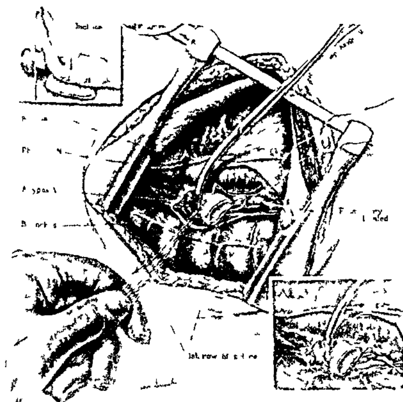


Fig 71 —Position of patient on table and anterolateral incision Closure of right primary bronchus mattress sutures leaving viable cuff of bronchus distal to suture line Lower insert sutured bronchus with viable ope cuff res d ng in med ast num

experiments and autopsy observations that the main point to healing of the bronchus is at the cut end To preserve viability of this portion by gentle handling and maintaining circulation in the bronchial artery they

(6) Ann Surg 116 481 531 O t t r 194?

have developed a method of closing the primary bronchus, successful in 25 of 27 total pneumonectomies

METHOD —The primary bronchus is amputated near the bifurcation of the trachea, leaving only a short stump, so that this may be contained well in the mediastinum Amputation is executed with the scalpel so that as little damage as possible is done to the cut end Crushing or cauterization is strictly avoided because devitalized tissue must be sloughed off or replaced by viable fibrous tissue from the neighbor



Fig 72 —Denuded area containing hilar structures covered over by mediastinal pleura interrupted silk sutures closing lips of pleura except at either end Four sutures apart from those closing incisions in the mediastinal pleura hold nonserous surface of mediastinal pleura in apposition to cut end of bronchus

hood and this invites infection Also, primary agglutination of the vital amputated stump of the bronchus to the surrounding or overlying areolar tissue thus is prevented, and the stump may be surrounded by vigorous granulation tissue originating from the mediastinal areolar tissue and also from the undisturbed peribronchial tissue The inferior thyroid artery gives off small branches to the lower end of the trachea and the first part of the primary bronchus In some individuals the bronchial artery applies itself to the posterior aspect of the primary bronchus some distance from the bifurcation of the trachea so that there may be a space between the areas supplied by the inferior thyroid arteries and the bronchial

vessels that has a relatively poor circulation The bronchus should not be dissected clean of its peribronchial areolar tissue, nor should the mucosa be disturbed in any way As a rule, the bronchial artery should be ligated at the cut end and not be occluded in one of the mattress sutures

With a very thin cutting needle, mattress sutures of fine silk or cotton are placed so that one leg of the suture passes around a cartilaginous ring (Fig 71) The space between the legs of the mattress sutures is 4 5 mm to avoid slough from strangulation of tissue between them They are placed



Fig 73 —Method of pulling mediastinal pleura over open cuff of bronchus peripheral to suture line when there is scarcity of mediastinal pleura

postero anteriorly, then back anteroposteriorly Six mattress sutures usually suffice to close the bronchus completely This closure should always be checked by filling the thoracic cavity with warm salt solution above the level of the closed bronchial stump and increasing intratracheal pressure If closure is not air tight bubbles will immediately appear

As few sutures as possible are used to preserve circulation and thus viability of the cut end The sutures are used only as a stop gap to prevent air from blowing to and fro on respiration during healing The suture line in the bronchus should be placed as high up on the stump as possible i e, near the bifurcation of the trachea because (1) if the sutures cut

through or form localized areas of infection these areas will be as far removed from the healing end of the stump as possible, (2) when the sutures are placed near the trachea there is less likelihood of interfering with the bronchial artery It is hazardous to place any form of suture in the cut end of the bronchus for sutures, regardless of the method of insertion or type of material will become infected and will cut The bronchus seldom heals as it was sewed at operation, but will open and heal by second intention The stump therefore

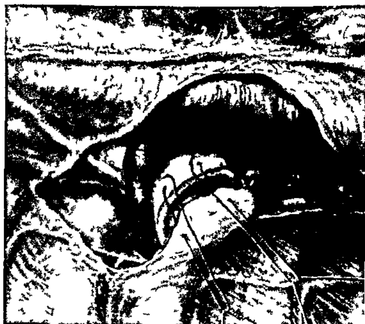


Fig 4 —Meth d of ele atin fl p f mediastinal pleura to cover bronchial stump (See al o Fig 75)

should be covered with mediastinal pleura as well as neighboring areolar tissue With patience, the pleura covering the aortic arch and the first portion of the descending thoracic aorta can be dissected off and sutured over the stump As there may be a space remaining between the end of the bronchial stump and the sutured mediastinal pleura because of bulging of the aorta into the thoracic cavity, it seems advisable to approximate the pleura carefully to the cut end by placing two sutures, anteriorly and posteriorly (Fig 72) If only an upper or lower leaf of mediastinal pleura is available it should be used The stump may be sutured down to the tissue immediately anterior to the vertebral column, or the wall of

the esophagus may be used on the left side as well as the outer covering of the pericardial sac On the right, the mediastinal pleural membrane is usually more abundant but when a considerable amount has to be sacrificed in removal of the tumor the azygos vein is ligated, divided and sutured over the bronchial stump In one case, enough pulmonary artery distal to its ligated portion was available for covering the stump on the left Mediastinal pleura is preferred (Figs 73-75), but other tissues may be used Apposition should be snug but openings should be left at either end of the suture



Fig 75 —Continuation of method in Figure 74

line so that if air leaks from the bronchus an avenue of escape is provided In a few cases, sulfanilamide was dusted around the bronchial stump before closure of the chest

Two of the 3 deaths in 27 cases were due to leakage from the bronchus after closure by this method, but in each a technical error was made In one the bronchus was clamped before amputation with a curved Kelly clamp to use this as a handle to pull on the hilus After the bronchus was cut the clamp slipped off, and it is believed that the occluding sutures were placed through

this devitalized area The end of the bronchus sloughed and the patient died of massive empyema Since then no clamps of any type have been used If feasible, bronchial occlusion sutures may be placed before amputation of the lung In the second case, the mediastinal pleura was sutured tightly and completely across the hilar defect on the left but was not properly brought into apposition with the bronchial stump Thus, a space was left in the mediastinum with no avenue of escape for air if the bronchus leaked Leakage occurred on eighth day, and mediastinal emphysema, followed by extensive subcutaneous emphysema, developed The eleventh postoperative day, when the patient seemed to be improving, he suddenly died At autopsy air emboli were observed in the anterior coronary veins The bronchus had opened, but the air could not escape There was an enormous mediastinal emphysema The bronchus had been closed with silk sutures as usual, and it is believed that if the mediastinal pleura had been brought into apposition with the cut end of the stump the bronchus would not have leaked Furthermore, an opening at each end of the sutured mediastinal pleura should have been left for escape of air

[The invention of a satisfactory method of closing the bronchial stump still constitutes one of the important problems of thoracic surgery The desirability of covering the stump with pleura is well recognized but it is not as easily accomplished as it may seem On several occasions the editor has seen a thoroughly satisfactory pedicle flap of pleura torn loose by movement of the stump created by a cough The suggestions of Rienhoff and his associates are however all good ones —Ed]

Tumors of the Mediastinum—S O Freedlander (Cleveland City Hosp) suggests the following classification

I Embryologic rests
- Dermoid—teratoma
- Aberrant lung tissue
- Bronchiogenic cyst
- Aberrant lobe

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(7) Ohio State M J 38 919 9 1 October 194

2 Neurogenic tumors
   Neurofibroma
   Ganglioneuroma
   Sympatheticoblastoma
3 Connective tissue tumors
   Lipoma xanthoma
   Fibroma—fibromyoma
   Lymphangioma—hemangioma
   Sarcoma
4 Primary tumors of lymph nodes
   Hodgkin s disease
   Lympho arcoma
   Endothelioma
   Boeck s sarcoid
5 Primary tumors of thymus
6 Carcinoma of mediastinum
   Primary
   Secondary
7 Echinococcic cysts
8 Intrathoracic goiter
9 Parathyroid adenoma

Many mediastinal tumors are benign and can be suc cessfully removed with little risk They will not respond to roentgen therapy They may remain entirely asymptomatic In dermoids or teratomas, symptoms rare ly occur before puberty neurogenic growths in the pos terior mediastinum may produce symptoms in infancy or childhood

Substernal oppression or pain, pain radiating to arms or shoulders irritative, unproductive cough and short ness of breath are usual Difficulty in swallowing or hoarseness may occur Severity of symptoms depends on rapidity of growth and size of tumor Cyanosis of neck and face with distention of veins of neck and anterior chest wall, may appear if the superior vena is com pressed Horner's syndrome suggests a lesion in the posterior mediastinum Expectoration of hair may prove the diagnosis of dermoid

There may be asymmetry of chest, diminished mobil ity with dulness and distant or absent breath sounds over the area involved All symptoms may be altered

and confused if the tumor becomes infected and establishes connection with bronchial tree or pleural cavity Diagnosis often cannot be made without operation

In all cases of myasthenia gravis tumor of the thymus usually benign, must be suspected Reports show benign thymomas in over 50 per cent of these cases In about 10 per cent of cases of hyperparathyroidism, the tumor is in the posterior mediastinum

While symptoms may suggest a mediastinal tumor, diagnosis of type and location cannot be made without roentgen examination in different planes For accurate localization this may be supplemented by bronchoscopy, bronchography and arteriography A sharply circumscribed spherical nonpulsating tumor in the anterior mediastinum suggests a teratoma the same kind of shadow in the posterior mediastinum probably represents a neurogenic tumor A tumor mass in the midst of the mediastinal contents often is a lymphoblastoma a metastatic gland or aneurysm Except for these few hints all the diagnostic procedures may not be adequate to establish type of tumor Occasionally aspiration biopsy is indicated However it is of value only if positive and is attended by some danger Arteriograms may be necessary to rule out aneurysm in centrally placed lesions

While asymptomatic benign tumor may long remain quiescent, in most cases it causes death by increase in size malignant degeneration or infectious complications Consequently, surgery must be considered in all cases Roentgen treatment may be useful in ruling out lymphoblastoma However it is wise not to give it until the patient has been seen by a thoracic surgeon

Intratracheal anesthesia with nitrous oxide oxygen and ether or cyclopropane is useful because the operations are transpleural For large growths Freedlander uses a posterolateral approach through an interspace or periosteal bed of a resected rib When the growth is small an anterior or posterior incision is used a small section of rib directly over the tumor is resected Every

effort is made to remove the growth completely in one stage Two stage operation partial removal, marsupialization or drainage is seldom successful The pleura is closed tightly with the lung expanded Postoperatively, effusion and air are frequently aspirated from the pleural cavity to reduce chance of infection

For benign growths uncomplicated by infection, mortality should be low In 12 operations for such lesions there was 1 death, in a case of chondroma which filled the entire left pleural cavity and could not be completely removed

[The editor agrees thoroughly with Freedlander s opinion that in all ca es operation is to be considered Far too often patients are advised by their physicians to wait until omething happens Practically all media tinal tumors can be safely removed when in a benign tage When they have become definitely malignant the progno is becomes hopeles The editor knows of no ca e of malignant media tinal tumor which has had a five year cure from any kind of treatment either surgical removal or x ray with possibly a rare exception of five year cure of Hodgkin s disease with x rays Teratomas have a particular tendency to become malignant Even neurofibromas become malignant in about 10 per cent of cases —Ed]

Endothoracic Sympathectomy —The thoracic sympathetic nervous system may reasonably be regarded as one of the more inaccessible parts of the body, but viewed from within the pleural cavity the sympathetic chain and splanchnic nerves are separated from this cavity only by the parietal pleura The possibility of section of the splanchnics and excision of the stellate ganglion via the thoracoscope was suggested to John Hughes[8] during operations on the lungs In most cases the roots of the great splanchnic nerve could be clearly seen glistening through the pleura thus giving a direct guide to the position of the nerve the position of the stellate ganglion was seen during operations for internal pneumolysis and gave support to the suggestion that such an operative approach was feasible

From trial on the cadaver it became obvious that the simplest method would be to work with two cannulas,

(8) I oc R y Soc Med 3 c J l 194

one for the thoracoscope and the other for the passage of instruments, and that it would be convenient to have two instruments that could be used simultaneously through the same cannula, one being a plain pair of forceps and the other a minute pair of scissors These instruments were specially made and proved sufficiently strong and satisfactory Together with a small blunt hook, they are all that are required for use with the standard thoracoscope It was also found that the pleura could be picked up and cut with the forceps and scissors thus exposing the underlying structures

TECHNIC —Both for excision of the stellate ganglion and section of the splanchnic nerves, the preliminary essential is complete pneumothorax on the side of operation, induced over a period of some days and checked by roentgenography

For splanchnic resection the patient is placed face down on the operating table, the thoracic cannulas are inserted under local anesthesia between the seventh and eighth and eighth and ninth ribs in the midaxillary line, the upper cannula being used for viewing and the lower for operating The pleura is anesthetized with 2 per cent novocain by the long standard endoscopic syringe An excellent view of the vertebral bodies is obtained, the diaphragm remains well down and the lung falls out of the way The area of the parietal pleura which is infiltrated should cover the space of three vertebral bodies and also extend outward to the necks of the ribs The sensitivity of the pleura seems to diminish in a forward direction so that while the pleura over the necks of the rib is highly sensitive, the part which is reflected on the mediastinum appears to be almost insensitive

An assistant holds the viewing cannula and thoracoscope steady, so that both hands of the operator are free to manipulate the instruments through the operating cannula The pleura is picked up at a convenient spot as low down as possible and cut with the scissors from the necks of the ribs to the front of the vertebrae Since the pleura is elastic it is quite easy to pick it up and clean, without danger of damaging other structures

The scissors are removed and the blunt hook is inserted With the forceps holding the pleura at the anterior end of the incision out of the way the hook is passed toward that part of the vertebral body where it passes out of sight and with a little gentle manipulation it is passed under the great splanchnic nerve The nerve is unmistakable as it can be

drawn well forward and will spring back again like a piece of elastic It is about the size of the median nerve at the wrist The nerve is grasped with the forceps and cut in two places as far apart as possible with the scissors By gentle dissection at the side of the vertebral body, the sympathetic chain can be cut in a similar manner

For resection of the stellate ganglion, the patient reclines on the table so that the chest is at an angle of 30 degrees with the horizontal In this position the lung falls down and back, leaving a good space in the region of the upper ribs. The cannulas are inserted under local anesthesia from the front this time, the viewing cannula between the first and second ribs and the operating cannula between the second and third, each about 2 in outside the lateral border of the sternum With both the direct and the oblique vision thoracoscope, an excellent view of the dome of the pleura is obtained, and the line of the great vessels can be plainly seen, the veins, including the intercostals, being particularly prominent The pleura is infiltrated with local anesthetic from above the neck of the first rib to the neck of the third and cut from below, upward The necks of the first and second ribs are thus exposed This area is cleaned by careful dissection with the scissors and forceps and the tissue removed kept for section In one of the patients operated on the sympathetic ganglion was definitely seen and its removal thus simplified, in another it could not be identified with certainty, and a more extensive dissection had to be carried out

In both of the operations described the bleeding consists only of a slight oozing from the minute vessels behind the pleura, which can be swabbed away by a small pledget of gauze held in the forceps

Sympathectomy by the endothoracic route was performed on four patients In one the procedure was carried out on both sides Omnopon, ⅓ gr , and scopolamine, $\frac{1}{150}$ gr , were used as premedication in four operations and only morphine, ¼ gr , in the fifth Two patients had hypertension in addition to which one of them had coronary occlusion One had a persistently painful amputation stump and the other Raynaud's disease

With this method it would be feasible to inject the sympathetic with alcohol under direct vision, and, if the pleura were allowed to heal before the pneumothorax absorbed, there seems to be no reason why the procedure should not be repeated indefinitely

Lobectomy for Pulmonary Tuberculosis—Edward D Churchill and Robert Klopstock[8] (Harvard Univ) report six cases of pulmonary tuberculosis three of which provided orthodox indications for resection of the lesion by lobectomy and three offered the usual indications for thoracoplasty but lobectomy was performed by election Healing per primam occurred in all cases

All patients were subjected to bronchoscopy pre operatively to rule out active ulceration in the trachea or stem bronchus Gas oxygen ether was administered through an intratracheal tube A posterolateral incision was used with resection of a single rib at the appropri ate level In areas overlying densely adherent cavities the dissection is transferred from the intrapleural to the extrapleural plane But in looking for a fissure one must be certain to return to the intrapleural plane A layer of thickened parietal pleura will completely obscure the fissure Meticulous hemostasis is maintained by ligatures and silver clips

The repeated statement that access to the hilus may be blocked by tuberculous infiltration of lymph nodes is erroneous Once the primary lesion is established tuber culous foci in an organ do not produce a lesion in the corresponding lymph nodes Upper or lower lobe lobec tomy is carried out by individual ligation technic

Following upper lobe resection, the lower lobe if ad herent is mobilized so that it may ascend to fill the apex Intrathoracic crushing of the phrenic nerve has been done to reduce temporarily the volume of the hemithorax Whether this is necessary or even advisable remains to be seen In thoracoplasty one fears lower lobe aspiration pneumonitis in the presence of a paralyzed diaphragm With surgical ablation of the source of sputum and

(8) A Surg 11 641 659 May 1943

complete freedom from paradoxical motion of the chest wall the conditions are considerably different

Silk technic is used throughout except for a proximal row of sutures penetrating the bronchial mucosa, where fine chromic catgut is indicated The pleural cavity is closed without drainage and the chest wall muscles are approximated by interrupted sutures of fine silk Intra pleural pressure is adjusted to a moderate degree of negative pressure An oxygen tent is used routinely for the first 24 hours Fluid or residual air may be reduced with needle aspiration, according to individual indica tions, preferably maintaining a moderate degree of nega tive pressure

If a lobectomy has been planned, technical difficulties that lead to resection of the entire lung must not be countenanced The goal of the operation is conservation of normal lung tissue as well as ablation of the diseased focus Interlobar fissures that have been obliterated by adhesions or anatomically incomplete fissures, can and must be developed by careful dissection Discovery of healed foci in adjacent lobes is not an indication for resecting them

Collapse therapy is satisfactory in a high percentage of cases of pulmonary tuberculosis that require radical therapy Its hazards are computable and not excessive It has lightened but not eliminated the great economic and temporal wastage of the disease It may for an in definite period remain the best form of treatment for most patients requiring surgical intervention However, lobectomy is more highly selective than thoracoplasty and as selective as the most skilfully managed pneumo thorax, assuming in the latter instance that healing and re expansion are prohibited by the actual pathology The functional capacity of the remaining lobe, or lobes, in the diseased side is preserved rather than encroached on by long continued artificial pneumothorax or thoraco plasty The anatomic integrity of the thoracic cage and

shoulder girdle remains essentially intact Most important is immediate ablation of the offending lesion Resection can only be considered after the patient's immunologic equilibrium has been restored by rest under a sanatorium regimen Empyema, bronchial fistula and implantation in the incision may otherwise be expected

Artificial pneumothorax is in no way incompatible with subsequent lobectomy When bed rest alone is insufficient to bring the disease under control, pneumothorax or phrenic nerve paralysis may be added If there is good reason to believe that the therapeutic goal of a re expanded lung, with a closed lesion, cannot be achieved within a reasonable time, lobectomy may be considered when the acute phase has been brought under control

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HEART AND PERICARDIUM

Claude S Beck[9] (Western Reserve Univ) successfully removed an *intrapericardial teratoma*

Man, 22, in 1932 had an enormously enlarged cardiopericardial silhouette (Fig 76) The presumed pericardial cavity was repeatedly tapped during the two subsequent years after which the roentgenogram of the chest was about the same as in Figure 77 A slight precordial bulge was present to the right of the sternum.

At operation, the fourth right costal cartilage was removed and a cyst, which was walled off from the general pericardial cavity, was emptied of 300 cc material which looked like water mixed with egg yolk and washed with solution of sodium chloride, the margin of the incision in the cyst was sutured to the pectoral muscle and the wound loosely closed without drainage Recovery was prompt

Symptoms of cardiac compression recurred temporarily in 1936 and in 1938 he developed a swelling in the region of the operative scar The roentgenogram of the chest is shown in Figure 78 At the second operation, the cyst contained hair, yellow fluid and masses of amorphous material In the base of the cyst the outline of aorta and pulmonary artery was

(9) Ann Surg 116 161 1 4 August 194

Fig 6 —Cardiopericardial silhouette greatly enlarged Bloody fluid was removed by aspiration heart was compressed

Fig 77 —Same case as p eceding three months later 500 cc. chocolate colored fluid removed by aspiration Cyst like out pouching of pericardium with smaller mass just abo e it de eloped on right side

seen The cyst wall, which was densely adherent to the region of the great transverse sinus, was dissected from aorta, pulmonary artery, vena cava, right ventricle and right inferior pulmonary vein Convalescence was uneventful Pathologic examination of the cyst walls showed squamous epithelium sebaceous and sweat glands hair follicles, epithelium resembling that of the upper and lower gastro intestinal tract, smooth muscle, normal fat and lymph follicles The diagnosis



Fig 8 —Same case five years later Wall of cyst shows deposition of calcium and some reduction in size

was cystic teratoma The patient was entirely well four years after operation

Only four cases of intrapericardial teratoma are reported in the literature and the present case is the only one in which the lesion was removed by operation

A case of a tumor like mass in the wall of the left ventricle is also described The identity of the lesion was not established it was probably not a true neoplasm This seems to be the first time that a benign lesion of the heart has been recognized clinically and the only case

in which removal of the lesion has been carried out The patient had a good result 18 months after operation Aneurysm of the left ventricle has not developed Beck considered placing a free graft of parietal pericardium over the tumor bed (Fig 79) but believed the parietal pericardium would become sealed to the tumor bed without it He recently applied this method in treatment of an aneurysm of the left ventricle



Fig 79 —Free graft of parietal pericardium might be applied to heart to reinforce weakened areas such as might occur after removal of a tumor or after myocardium has been severely bruised This procedure might prevent rupture of a ventricle or formation of an aneurysm of heart

In their experiments on dogs to produce new *communications between the coronary arteries by the application of inflammatory agents to the surface of the heart,* Paul Schildt Eugene Stanton and Claude S Beck[9] (Western Reserve Univ) found that powdered asbestos was the most satisfactory substance It reduces the mortality and size of the infarct following ligation of a coronary artery It is a safe surgical procedure in animals

(9) Ann Surg 118 34 45 July 1943

mals if a dosage of 0 1 to 0 2 Gm is not exceeded Inflammatory agents used on the heart may have harmful side effects and should not be used indiscriminately

Alfred Blalock and Mark M Ravitch[1] (Johns Hopkins Univ) consider the *nonoperative treatment of cardiac tamponade resulting from wounds of the heart* The reported mortality from these wounds treated by operation is about 50 per cent Most deaths have resulted from the injury itself but many are due to untoward incidents during operation or to postoperative complications The mortality rate is high even in the hands of those who have performed a number of such operations, and it is likely that the rate is considerably higher when the procedure is carried out by those with less experience Besides, isolated unsuccessful cases are usually not reported

The question arises whether the total of successful end results would not be greater if a more conservative policy in regard to immediate operation were adopted in instances in which there is no active bleeding through the chest wound or into the pleural cavity In other words, is one warranted in delaying operation and using nonoperative means, including aspiration, in cases in which the symptoms are due to tamponade rather than to continued active bleeding? If the answer is yes all facilities should nevertheless be available for immediate operation, and there is a limit to the time (probably two hours) that tamponade may be allowed to persist If blood reaccumulates rapidly following aspiration, exposure and suture of the heart wound are indicated If more than one aspiration is necessary, at least 15 minutes should be allowed between paracenteses to increase the chances of closure of the wound by a clot If there is good reason to believe that an auricle rather than a ventricle has been injured, operation may be more safely deferred This is in agreement with directions prepared

(1) Surgery 14 157 162 August 1943

recently for medical officers in the U S Army and referring to the treatment of penetrating heart wounds with resulting tamponade "(1) Aspirate the blood from the pericardium by the costoxiphoid route, if possible (2) Repeat if there is a recurrence (3) If it again recurs, perform a cardiorrhaphy through an extrapleural exposure"

H M Blegen[2] (Missoula, Mont) reviews 17 cases of *wounds of the heart* seen at St Joseph Hospital Lexington, Ky , in 14 years Nine were due to shooting, six to stabbing and two to nonpenetrating body blows Thirteen patients were colored and 4 white, 16 were males and 1 female

Seven had cardiac tamponade proved at operation or autopsy Of these, the wound was located in the right ventricle twice the right auricle three times and the intrapericardial portions of the great vessels twice

Four patients with cardiac tamponade were operated on, two recovered Five patients died in the emergency room before treatment could be given Six were not offered surgery, although they lived over an hour, one of these recovered under conservative measures only Of the two patients with cardiac injury resulting from nonpenetrating body blows, proved at autopsy, one had cardiac tamponade from rupture of the right auricle and lived five hours after admission, the other had a ruptured auricular endocardium which was not detected clinically and would have been compatible with life had not the patient died of gas bacillus infection in an accompanying laceration of the foot

Operative mortality was 50 per cent Corrected total mortality was 73 per cent (three recoveries and eight deaths) The high mortality was due in part to the fact that signs and symptoms of tamponade frequently were not carefully sought and that this series contained a high percentage of severe gunshot wounds

(2) Journal Lancet 63 1 7 January 1943

Modern surgical methods have reduced mortality of cardiac tamponade resulting from penetrating chest wounds from 90 per cent in untreated patients to 50 per cent or lower in those properly handled Many patients admitted with this syndrome are considered beyond medical aid because they usually appear to be on the verge of death, and resident staffs in many small hospitals are not acutely conscious of the relief that might be obtained by early diagnosis and operation Everyone treating patients in emergency rooms should be constantly prepared and encouraged to handle this type of case

Definite diagnosis can usually be made by three simple tests venous pressure readings, fluoroscopy and, if necessary, pericardial aspiration

Cardiac injury from nonpenetrating body blows is more frequent than is suspected Many patients with these milder injuries recover without being detected clinically While cardiac tamponade following a body blow has been discovered occasionally at autopsy, no case has been diagnosed and relieved surgically Therefore all patients especially those injured in automobile accidents who show signs of cardiovascular collapse out of proportion to blood loss or other injuries should be examined carefully for tamponade with the hope of saving some of them by early operation

The four cases with operation are described In two an unconventional long parasternal incision carried through four costal cartilages gave excellent exposure by spreading the entire thoracic cage Regardless of the type of incision intercostal arteries must be ligated The lung and pleura if not injured are pushed laterally exposing the pericardium which presents as a tightly distended pulseless sac This is opened widely and the blood removed As soon as pericardial pressure is relieved, heart contractions increase in force The left hand gently introduced behind the heart lifts the organ and a traction suture is passed through the apex With

this as a guide, the wound is sought Beck suggests holding the traction suture between the middle finger and thumb of the left hand and placing the index finger over the wound in the heart A suture is then introduced on either side of the wound The index finger is withdrawn and the control sutures are crossed and pulled against each other This controls the bleeding and allows the operator to place permanent sutures Care must be taken not to injure the coronary vessels In injury to the right auricle it must be borne in mind that the sino auricular and atrioventricular nodes are located in the posterior wall of this chamber

After the wound is sutured the pericardial cavity is irrigated with saline solution and closed loosely with interrupted sutures space being allowed for the escape of fluid

Postoperative care consists of restoration of blood administration of oxygen if necessary and strict bed rest for at least three weeks to prevent increase in the intracardiac pressure and resultant increase of tension on the sutures Blood in the pleural space may or may not be removed depending on the degree of respiratory embarrassment Morphine is given freely Careful venous and blood pressure readings should be made frequently so that any recurrence of tamponade may be detected early and pericardial aspiration done

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ABDOMINAL SURGERY—GENERAL

Abdominal Wound Suture—According to H Minor Nichols[2] (Portland Ore) the reported rate of occurrence of wound dehiscence ranges from 0 5 to 2 per cent Since the average reported mortality following this accident is over 30 per cent with the underlying pathology responsible only in part for many of the deaths

( ) W I Surg 1 1 0 Ja u n 194

every possible effort should be made to prevent it

The incidence of dehiscence is particularly high after laparotomy for the repair of gunshot and stab wounds of the abdomen In these cases there is usually no opportunity to prepare the patient with additions to protein and vitamin content of the blood, wound infection is common and postoperative distention is usual Such circumstances may lead to dehiscence after any emer

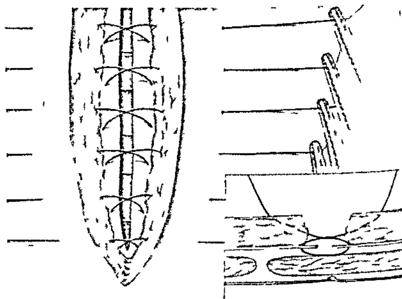


Fig 80—After closing peritoneum with running chromic catgut (not illustrated) figure of eight sutures of no 28 stainless steel wire are inserted Note that suture encircles relatively large bite of fascia Hemostats were placed on both ends of all sutures

gency operation and it is for these cases that the method of abdominal wound suture to be described was devised

The vertical rectus incision is practically the only type of incision suitable for gunshot and other abdominal wounds and is the most widely used incision for emergency surgery Since about 5 per cent of muscle splitting incisions will result in atrophy of the medial fibers of the rectus a muscle displacing maneuver is

to be preferred Displacing the muscle has the added advantage that it tends to prevent hernia, as the tensed muscle slides across the openings in the fascia and peritoneum Its only disadvantage is that it tends to prevent drainage of the abdomen The proposed suture method is also suitable for other abdominal incisions

TECHNIC —The peritoneum and transversalis fascia are first sutured with a running double strand of chromic catgut which

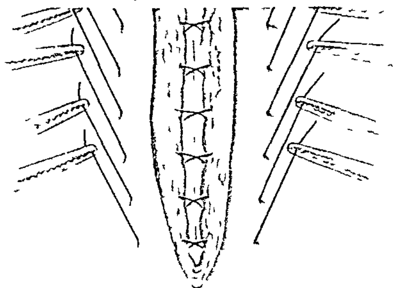


Fig 81 —Traction on all sutures at once closes fascia

may be loop knotted at intervals or re enforced with a few interrupted sutures Figure-of eight sutures of no 28 stainless steel wire are then inserted about ½ in apart, making a fair sized loop in the fascia over the rectus (Fig 80) The sutures encircle relatively large 'bites' of fascia Care must be exercised not to kink the wire or form knots in the buried layer The sutures are held with hemostats on both ends Traction is then made on all hemostats simultaneously closing the deep structures (Fig 81), after which the wire has sufficient stiffness to prevent opening of the buried loop when the hemostats are relaxed Each suture is then completed as a vertical mattress suture of the skin (Fig 82)

A little experience with this stitch will enable the operator to judge how far from the skin edge to insert the needle first Patients with heavy subcutaneous fat layers require a wider stitch and supplementary skin closure When all the sutures are inserted each is tied and the ends cut short No tension is exerted These sutures are not removed until the tenth to the fourteenth day or longer, depending on the case

Nichols has never had difficulty in removing these wires He has used the method in many cases complicated by delirium tremens and severe cough and has re

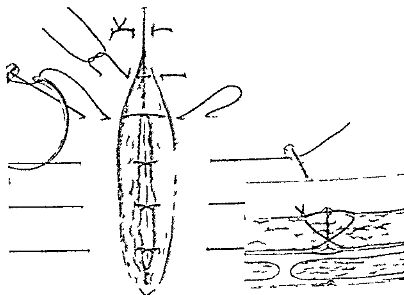


Fig 8 —Suture completed as vertical mattress wires are tied very loosely (e g over assistant finger) Occasionally a few supplementary stitches are needed in the skin

duced the incidence of dehiscence from about 2 per cent to about 0 5 per cent in 100 abdominal sections The incidence of wound infections has been numerically lower in potentially infected wounds closed with wire than in supposedly clean wounds closed with catgut or silk This method is not to be used indiscriminately in every case The best indications are potentially infected wounds with good fascial layers, the storm warnings being set for postoperative complications

Injuries—R M Moore and J C Kennedy[3] (Univ of Texas) review treatment of *penetrating wounds of the abdomen* encountered during 1931 to 1941 The essential principle in managing these injuries did not vary Every wound of the abdomen or of the lower part of the chest wall was considered potentially a perforation of an abdominal viscus Consequently immediate exploratory laparotomy was performed in every case in which local examination of the wound (relying on excision and dissection rather than on probing) failed to convince a surgeon that the wound stopped short of the abdominal cavity

This report is based on 75 consecutive cases (stab wounds, 40, gunshot wounds, 35) in which penetration of the abdomen was established at operation The stab wounds were in the abdominal wall in 31 cases, in the lumbar region in 1 and somewhere in the chest wall in 8 In the last group thoracotomy sometimes preceded laparotomy in which case the wound of the diaphragm was sutured from above

In 14 of the 40 cases no serious internal injury could be found, although penetration of the peritoneum was proved at laparotomy In four, the only indication of internal injury was a large retroperitoneal hematoma In eight, there were one or more wounds of the liver, in four of these, hemorrhage was stopped and suture of the liver was not needed In 14 the gastro intestinal tract had been perforated in one to four places Four patients failed to recover a mortality of 10 per cent Severe shock or critical hemorrhage was unusual, and none of the four deaths was attributable to hemorrhage Simple suture of perforations was ordinarily the only operative treatment required The abdomen was drained in only six cases After operation the patients were treated as though threatened by peritonitis parenteral fluids being given while constant gastric suction was maintained for several days The cause of death was

(3) War Med 2 912 916 November 1942

peritonitis on the third day in one patient, peritonitis and abscesses of the liver after five weeks in one and pulmonary complications in two alcoholics

In 33 of the 35 cases of proved abdominal penetration by gunshot, the missiles were bullets of various calibers, in the other two, injury was inflicted by shot The entrance of the gunshot wound was located on the abdominal wall in 24 cases, on the chest wall in 6 and on the back, hip or perineum in the remaining 5 In the 35 cases there was intra abdominal injury, although in 7 in which there were large retroperitoneal hematomas the exact injury could not be determined The incidence of injury to individual organs was pancreas, 1, kidney, 2, spleen, 2, liver, 7, urinary bladder, 3, stomach, 4, duodenum, 1, jejunum or ileum, 15, colon, 11, and large vessels (aorta, iliac vessels, caval vessels), 4 In many cases, multiple injuries were present Thirteen patients failed to recover, a mortality of 37 1 per cent Severe hemorrhage and shock were prominent features The mortality was 40 per cent in gunshot wounds of the small intestine 50 per cent in wounds of the stomach and 56 per cent in wounds of the colon However, penetration of the gastro intestinal tract was not so important a factor in determining mortality as was the amount of accompanying hemorrhage In all cases of gunshot wound of the spleen or large vessels the patients died, while in all other fatal cases hemorrhage was so extensive that the abdomen was filled with blood

Although it is generally appreciated that a bullet entering the thorax at an angle may travel downward into the abdomen, an inexperienced surgeon often fails to think of the abdominal organs when dealing with a stab wound of the chest Penetration of the diaphragm should always be suspected when a stab wound has occurred in the lower portion of the chest This is particularly important when the wound is on the left side, where hollow organs lie immediately beneath the

diaphragm In cases of such injury exploration of the left upper abdominal quadrant may reveal penetration of the stomach, spleen or colon It is less serious to over look penetrations of the diaphragm on the right side, since the bulk of the liver protects the hollow organs and hemorrhage from a simple stab wound of the liver is often slight

It is to be expected that introduction of sulfanilamide into the peritoneal cavity following closure of traumatic perforations of the intestine will lower the incidence of fatal peritonitis That this will have a marked effect on the mortality in gunshot wound of the abdomen does not necessarily follow In civil life, at any rate, many patients with gunshot wounds of the abdomen die from hemorrhage and shock before there has been time for peritonitis to develop

Lionel S Auster and John H Willard[4] (M C, U S N R) discuss *hydraulic abdominal concussion* and give several illustrative cases Usually a man is in the sea, within a radius of 100 to 300 yd from where a depth charge explodes under water, forceful water cur rents are generated, producing external abdominal com pression simultaneous with the entrance of sea water into the bowel through the anus Within half an hour there are usually 3 10 fluid bowel movements accom panied by violent cramps Dehydration and shock are common Bowel irritability, with repetition of the fluid stools continues for several days and sometimes for two weeks

In patients with severe peritoneal irritation, the chief lesion is miliary, discrete and confluent, subserosal and mucosal intestinal hemorrhages, frequently with larger areas of ecchymosis and hematoma The serosal irrita tion produces the peritoneal signs The breakdown and tension about larger areas of intramural hemorrhage and damage to mucosa have produced evidence of minor

(4) J A M A 121 995 999 Mar 27 1943

and major intestinal bleeding Late results may vary from nothing to active or healed ulcerative colitis

Relatively rare examples of macroscopic perforation seen at operation were always in the colon, either pin point or longitudinal and at a distance from the rectum, their occurrence probably depending on a combination of factors including degree of pressure within and without the bowel lumen and amounts of fecal material and gas present Most perforations seem to be "blow outs" at a point where a bubble of gas compressed from below meets an obstruction, only this explains the occurrence of leaks in the cecal area and transverse colon The longitudinal nature of the rents is consistent with the anatomic structural weakness found in the colon in this direction

Treatment requires good judgment and, at times courage to withhold operation in the face of what seems an urgent abdominal emergency Experience has shown that supportive treatment without operation produces best results Manifestations of frank major perforation are indications for operation Despite all modern technics and even with chemotherapy, mortality is unusually high and apparently unavoidable Treatment of small perforations and the peritoneal inflammation secondary to intramural intestinal hemorrhage and concussion has been most successful with morphine, indwelling intestinal suction drainage and intravenous infusions of electrolyte dextrose and plasma

Abscess—Harry E Bundy[5] says the frequency of *subphrenic abscess* in surgical practice is not definitely known The more common predisposing etiologic factors are acute appendicitis, perforated peptic ulcer and gall bladder or biliary disease Occasionally, diverticulitis, pancreatitis and suppurative pleural conditions are causative factors When in the course of any of these conditions, the patient fails to do well and develops a fever of undetermined origin, leukocytosis and chills with pain

(5) M Bull. Vet Admin. 18 410 412 April 194-

in the region of the liver or diaphragm or radiating to the shoulder, subphrenic abscess is to be considered There may be localized pain along the twelfth rib or costal margin on the right side, and roentgen examination may show elevation of the right side of the diaphragm with fixation and, occasionally, fluid in the right pleural cavity In the later stage of the condition there may be a bubble of air above the liver The question of aspiration as a diagnostic measure must be carefully weighed This procedure is condemned by most clinicians When aspiration is desired, it should be done below and posteriorly thereby preventing contamination of the peritoneal cavity The most frequent organisms encountered are the colon bacillus, streptococcus and staphylococcus

Treatment of subphrenic abscess is surgical, consisting of proper incision and drainage The two approaches to the posterior superior abscess are transpleural and transabdominal The transpleural route requires resection of the ninth or tenth rib, with suturing of the costal and diaphragmatic pleura and puncture or incision below, to prevent contamination of the pleural cavity The transabdominal route, advised by Ochsner, calls for subperiosteal resection of the twelfth rib and incision transversely on a level with the spine of the first lumbar vertebra, to prevent contamination of the pleural cavity, the kidney is to be displaced downward and the abscess sought by the examining finger and extraperitoneally opened

The present trend is toward conservative measures because healing appears to occur in most cases without surgical intervention However when the clinical picture suggests suppuration operation should be performed without delay In some instances when operation is performed the abscess is not located—a fact which may be explained by some further complication, such as perforation of the diaphragm, incorrect localization of the abscess or, in a small percentage of cases a spontane

ous healing without localization When the abscess is located in the posterior superior space and perforation occurs through the diaphragm, empyema, lung abscess or bronchial fistula may result

Bundy reports a case

Man, 43, with a history of stomach trouble of several years' duration, was hospitalized for perforated peptic ulcer and operated on without delay under spinal anesthesia A perforated gastric ulcer was found near the pylorus, on the anterior and superior aspect of the stomach There was some fluid in the peritoneal cavity The area immediately surrounding the ulcer was indurated Plastic closure was done, the fluid aspirated and the abdomen closed The patient was put to bed in the Trendelenburg position for eight hours, nasal suction was instituted, and 1,000 cc of 5 per cent glucose in normal saline solution was given intravenously every eight hours Pain was controlled by opiates

Convalescence was smooth until the sixth postoperative day, when the patient had a severe and sudden pain in the epigastrium When the wound was reopened the site of the former perforation was found to be normal but there was turbid fluid in the right upper gutter, which was carefully aspirated and sponged away A corrugated rubber drain was then placed in the right upper gutter over the dome of the liver, coming out of a stab wound to the right of the incision with a second drain leading down near to the site of the previous perforation Following this procedure, the patient appeared to do well There was, however, some purulent drainage

The drain was removed on the seventh postoperative day but two days later he had some rise in temperature, which persisted about three or four days and then subsided At this point it was believed that a subphrenic abscess was present The patient was given a transfusion of 200 cc whole blood following which he appeared to improve One week later, he complained of pain in the right shoulder, this symptom lasted for approximately three weeks and then suddenly subsided There was also an occasional paroxysm of coughing, which, however, did not appear to be unusual

Six weeks after operation he had an elevation of temperature, and examination revealed fluid in the right pleural cavity Aspiration gave a clear, straw colored fluid which, on culture, produced a gram positive diplococcus The patient at this time was given 350 cc whole blood, with benefit

A week later it was decided that a subphrenic abscess was

definitely present and exploration was performed The technic advised by Ochsner was followed—resection of the twelfth rib on the right posterior aspect and making the incision transversely to the spine of the first lumbar vertebra When the subdiaphragmatic area was explored, no definite abscess was found

The patient's condition was satisfactory for three or four days, when he apparently had a relapse with paroxysms of coughing, resulting in production of large amounts of purulent material It was now evident that he had developed a lung abscess, and his death occurred a few days later

Autopsy disclosed a perforation of an old subdiaphragmatic abscess, which had penetrated through the diaphragm where the pleura had become adherent and had terminated in a single large abscess in the lower right lobe, with multiple abscesses in the middle and upper lobes The site of perforation had healed and was discovered only after considerable search, but there were adhesions between the stomach and the liver, anteriorly indicating the pathway of the infection, which had terminated in abscess formation

Technic—In an *anatomic and clinical study of the transverse abdominal incision,* Vincent L Rees and Frederick A. Coller[3] (Univ of Michigan) show that this incision is based on sound principles It parallels the lines of skin cleavage, the heavier muscular and aponeurotic fibers and the greater portion of the nerves of the anterior abdominal wall (Fig 83) As a result of the stronger incisional closure thus afforded, there are fewer eviscerations, herniations and abdominal adhesions

Transverse incision in many instances allows better and easier exposure This is especially so in operations on the gallbladder, because the incision approaches the operative field more directly For operation on the upper part of the abdomen a transverse incision need not extend into that portion of the celomic cavity where the greater portion of the small intestine lies This practically eliminates this structure from the operative field Thus easy exposure is accomplished without repeated packing and manipulation of the small intestine Hyperextension of the patient will further aid exposure and

(3) Arch Surg 47 136 146 August 1943

facilitate operation This helps reduce trauma and favors a smoother postoperative course The little extra time needed to make transverse incisions is usually more than offset by that ultimately saved as a result of improved exposure

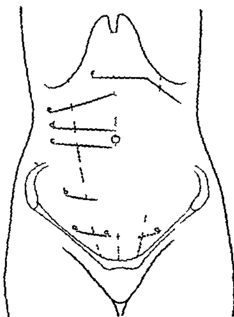


Fig 83 —Common locations for transverse incision a–a unilateral inguinal herniorrhaphy incision a–a incision used for bilateral inguinal herniorrhaphy b Davies or Rockey appendectomy incision c laparotomy incision especially valuable in cases of intestinal obstruction (similar incision on left gives good exposure of sigmoid colon) d incision used for right colectomy e incision giving good access to biliary system (similar incision on left used for splenectomy) f incision used for gastric operations.

The incidence of pulmonary complications found after 22 consecutive transverse incisions in the upper part of the abdomen was 2 6 per cent which is considerably below the 9 5 per cent for a comparable series of vertical incisions

The virtual absence of incisional pain the narrow, firm cicatrix and the average reduction of from 5 to 10 days in the period of hospitalization are advantages worthy of consideration A patient with a transverse incision can, if conditions warrant be allowed up with relative safety almost as soon as he has recovered from the anesthetic

Thomas E Jones John R Paxton and Robert E Brubaker[6] (Cleveland Clinic) use a modification of the *Mikulicz pack* consisting of a sheet of rubber dam into which a long fold of gauze is packed This may be applied in two ways depending on size and shape of area to be covered (1) A large square sheet of rubber dam

(6) Ann. Surg 117 256 267 February 1943

is placed against an unperitonealized area and packed with the gauze fold until the cavity is filled with the bulk of the pack (Fig 84) The four edges of the square are gathered together and brought out of the abdominal wound together with the inner gauze fold, the

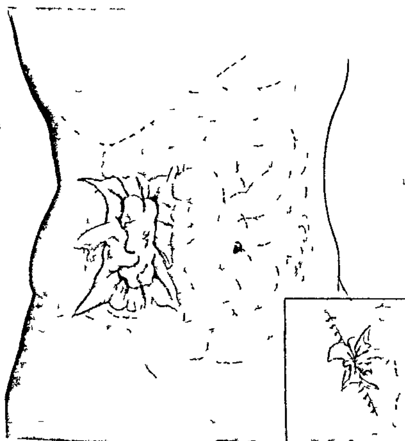


Fig 84 —Diagrammatic sketch of pack after closure

pack assuming a saclike shape with the neck at the abdominal wall One need not be concerned about formation of a large intra abdominal cavity with a relatively narrow opening, since it collapses rapidly a few days after the pack is removed (2) In a deep narrow, unperitonealized area one edge of a rectangular piece of

rubber dam is placed into the bottom of the area and folded over gauze packing, forming in appearance a large cigaret drain

In each method the inner gauze packing is removed gradually, beginning the third or fourth postoperative day The last portion of the pack and the rubber dam are usually removed 8 11 days postoperatively A large rubber tube or catheter is placed in the cavity formed by the pack and irrigations carried out as often as nec essary until it closes With careful postoperative atten tion such cavities assume the shape of vertical sinuses in a week and the wounds heal entirely in 6 to 10 weeks

This type of pack was of greatest value in regional enteritis, especially with enterocutaneous fistulas in neoplasms of the sigmoid colon and the splenic and hepatic flexures No hernias of the abdominal wound have been observed at the point of exit of the pack, which is attributed to use of alloy steel wire in wound closure No enterocutaneous fistulas, residual abscesses or persistent sinuses have occurred

For effective *skin protection in ileostomies and colos tomies* David Presman[8] (Chicago) uses the following formula

Vinylite resin	25 Gm
Acetone	100 cc
Collodion	25 cc

TECHNIC —The first application of the solution is best done immediately prior to opening the enterostomy Any ointment present must be completely removed and all skin area thor oughly cleansed with ether and acetone The solution is poured on the skin around the incision and smeared evenly with applicator or tongue depressor The sides of the exteriorized bowel may be covered with the solution without harmful effect At least 10 to 20 minutes must be allowed for thor ough drying of the solution and formation of adequate film The bowel is then opened and a dry sterile dressing applied The solution is reapplied without removing previous coats

(8) Surgery 13 322 323 February 1943

as often as necessary, depending on consistency and amount of fecal drainage This may vary from several times daily to once every few days

With this solution, absence of skin irritation has been striking The solution also protects the skin in cases of fecal fistulas and profusely draining infected wounds

Thomas L Ramsey[7] (Toledo, O) calls attention to *magnesium silicate granuloma* produced by use of the powder in surgical procedures and adds four cases to the meager literature This powder should be eliminated from operating rooms, surgical dressings, rubber gloves drains and dams It adheres readily but can be removed from gloves and other rubber surfaces by thorough washing If used at all on rubber gloves, care must be taken that no excess is present in the finger tips, as escape of powder through a tear in the glove while working in the peritoneal or other body cavity will be followed by nature's effort to wall off the irritating substance if too much of it is present

Magnesium silicate can be considered a factor in the production of granulomatous lesions when the crystals are found in tissue sections There is generally an early active reaction with attraction of phagocytic cells and lymphocytes to the involved areas Giant cells form about the crystals and finally fibroblastic proliferation is stimulated The crystals may or may not be readily recognized in the tissues and the giant cells with ordinary illumination, but properly placed polaroid glass or cut film between the light source and the eye brings them out because of their refractile power

(7) Am J Clin Path 12 553 558 November 1942

PERITONEUM, MESENTERY AND OMENTUM

Peritoneum —*Biliary Peritonitis without Perforation and Acute Pancreatitis*—Work of various authors leads Alfonso R Albanese[9] (Buenos Aires) to conclude that reproduction of biliary peritonitis without perforation requires three factors activated pancreatic juice, a micro organism and biliary stasis An interesting fact is that the exudate is usually hemorrhagic and that the animal easily dies Clinically, the disease resembles acute pancreatitis This is of special importance because Albanese treats acute pancreatitis with splanchnic semilunar anesthetic block, and if biliary peritonitis without perforation is a separate entity which requires immediate operation but can easily be confused with acute pancreatitis, he might use anesthetic block, thus missing the opportune moment for intervention in one condition or curing the process in the other condition

However, there is another explanation for the observed facts (1) The filtration and microscopic perforation theories cannot explain the biliary exudate in cholecystectomized patients or in those with sclerotrophic gallbladder and with obstructing calculus in the cystic duct and choledochus with gallbladder and biliary passages protected against the action of the pancreatic juice (2) These theories cannot explain the infrequent occurrence of biliary pigments, absence of bile salts and frequent presence of pancreatic enzymes in the exudate The usual hemorrhagic character of experimental peritoneal exudate has already been mentioned (3) An exudate of biliary character is frequently observed in anatomic conditions which characterize acute pancreatitis (4) A case of acute pancreatitis is cited in which biliary exudate containing bilirubin was accidentally noted (5) Presence of pancreatic juice in the gallbladder and biliary passages observed in some cases of

(9) Semana méd 49 662 664 Sept 17 1942

biliary peritonitis without perforation cannot explain the pathogenesis, as it has frequently been found in patients cholecystectomized for acute pancreatitis and in normal subjects (6) The high operative mortality of biliary peritonitis without perforation is similar to that of acute pancreatitis (7) Finally, in about 150 cases of acute abdominal conditions in which the author tried splanchnic semilunar anesthetic block for diagnostic and therapeutic purposes, and among which there were 34 acute and 5 subacute cases of pancreatitis, he has not found a single case of biliary peritonitis without perforation

From these observations he concludes that so called biliary peritonitis without pancreatitis is actually acute pancreatitis with biliary exudate and that it must be treated as any acute pancreatitis, i e, with repeated bilateral splanchnic semilunar anesthetic block

X Ray Treatment of Acute Peritonitis—James F Kelly and D Arnold Dowell[1] (Omaha) discuss the possibility of a similar etiology for acute peritonitis of intestinal origin and gas bacillus infection and review the underlying pathologic picture of the various stages of this type of peritonitis in a plea for early use of roentgen therapy

The technic cannot be definitely fixed, as the requirements of each case must be met promptly and individually to give the best results Variables are the number of treatments each day (one to three), roentgens per dose (50 75, occasionally less and sometimes more), kilovoltage (90 130 kv) filter (2 5 mm Al) and distance (40 50 cm)

At Creighton Memorial St Joseph's Hospital from 1934 to 1940, 3 579 patients were examined, of whom 290 showed peritonitis in some form There were 202 with generalized peritonitis with or without abscess formation 100 died This high mortality rate (49 5 per cent) makes the group suitable for study of the different

(1) Radiology 38 299 306 March 194

Peritoneum—*Biliary Peritonitis without Perforation and Acute Pancreatitis*—Work of various authors leads Alfonso R Albanese[9] (Buenos Aires) to conclude that reproduction of biliary peritonitis without perforation requires three factors activated pancreatic juice, a micro organism and biliary stasis An interesting fact is that the exudate is usually hemorrhagic and that the animal easily dies Clinically, the disease resembles acute pancreatitis This is of special importance because Albanese treats acute pancreatitis with splanchnic semilunar anesthetic block, and if biliary peritonitis without perforation is a separate entity which requires immediate operation but can easily be confused with acute pancreatitis, he might use anesthetic block, thus missing the opportune moment for intervention in one condition or curing the process in the other condition

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[This article belongs in the raised eyebrow department. Ain t x rays wonderful Mabel?—Ed]

Intraperitoneal Injection of Vaccine to Prevent Post operative Peritonitis —Claude F Dixon, J Arnold Bargen and William J Tennison[2] (Mayo Clinic) conducted a two year study in which vaccine was given alternate patients to be subjected to operation on the colon Any patients considered unacceptable for vaccine treatment, i e, those with a large perforation, were excluded The material included 480 patients on whom, counting operations in multiple stages, 639 operations were performed Vaccine was administered prior to operation to 258 and was not given to 381 Postoperative mortality was 7 per cent in the first group and 10 2 per cent in the second Considering only hospital deaths of patients in whom peritonitis was found clinically or at autopsy, the mortality for the first group was 3 9 per cent and for the second 6 6 per cent Comparisons made separately according to type of operation and surgeon showed a consistent advantage for the group receiving vaccine in about the same proportion as indicated for the over all average results

METHOD —The patient reclines on his back If the lesion is on the left side of the abdomen, the injection should be on the right side If it is above the umbilicus, the injection should be below it The injection should not be made more than 2 in from the umbilicus in any direction unless there is a special reason The risk of perforation of the urinary bladder, stomach liver, cecum or sigmoid is thus avoided The mid line is best avoided

The skin is cleansed with alcohol and ether and painted with iodine or tincture of merthiolate Drapes are placed over the operative field, and rubber gloves are worn

A skin wheal is raised with procaine hydrochloride The fascia and the muscle layers are infiltrated A large caliber needle (no 16 20) is used to puncture the abdominal wall through the infiltrated area The point of the needle is introduced into the peritoneal cavity not more than ¼ ½ in The syringe is fastened to the needle and gentle aspiration effected

( ) Arch Surg 45 507 520 October 1942

methods of treatment used in addition to surgery Of 109 patients treated by surgery supported by general measures, 71 died Of 42 treated by sulfonamides and surgery with general measures, 16 died Of 21 treated with a combination of roentgen irradiation, sulfonamides and surgery supported by general measures, 7 died Of 30 treated by roentgen irradiation as an aid to surgery and with general measures, 6 died These data show that x rays are of value in treating acute general peritonitis that when they are used and sulfonamides are omitted the result is better than with a combination of the two measures and that x rays are much more efficient than sulfonamides alone

If all patients receiving roentgen therapy are considered together, they form a group of 51 with 13 deaths, or 25 4 per cent, if all receiving sulfonamides are grouped together there are 63 with 23 deaths, or 36 5 per cent

The value of early irradiation in peritonitis secondary to appendicitis cannot be overemphasized During the acute spreading serosanguineous phase, the disease responds more promptly and completely to irradiation and seems to undergo thorough resolution without complications The authors have observed excellent results from prophylactic roentgen irradiation and recommend it to prevent extension of a localized peritonitis or inception of peritonitis after injuries, such as gunshot wounds

Conditions which preclude the possibility of success in treatment of peritonitis with x ray are (1) delayed use of the x rays—pathologic process too far advanced, (2) organic obstruction of the bowel—not operated on (3) open and leaking perforation in the bowel, (4) internal use of the early sulfonamides simultaneously with x ray therapy, and (5) fatal underlying organic pathologic process, such as advanced cancer and its complications

an active means toward such a union R J Behan[3] (Pittsburgh) selected the organic base lanolin as a means of separating the opposing serosal surfaces because of its marked adhesive and nonirritating properties Boric acid was added because it is not irritating and has a certain low antiseptic value The lanolin must be as nearly pure as possible The paste (lanolin 95 per cent and boric acid 5 per cent) should be sterilized on three different days for one hour at 240 F Before being used it is heated until it flows freely When it is applied in a fluid form and fairly warm to the peritoneal surface, the excess moisture in the peritoneum is evaporated and its surface dried The paste sticks to it firmly As a further precaution against formation of adhesions, the patient's position should be changed every hour after operation In case of adhesions between the omentum and the lower abdominal or pelvic viscera, the foot of the bed should be elevated

Precision care and gentleness in operative technic are important In closing the abdominal incision the edges of the peritoneum should be everted Immediately after operation, the peristaltic movements of the stomach and bowel are stimulated by use of prostigmine 1 ampule intramuscularly every fourth hour Eserine salicylate 1/30 gr, has also been found useful every fourth hour until intestinal distention is relieved These should alternate with each other every second hour If the stomach should become dilated gastric lavage and insertion and retention of a Jutte or a Levin tube are necessary If intestinal dilatation is severe and ileus is thought to exist a Miller Abbott tube is inserted and kept in place until active peristalsis occurs and distention is relieved A rectal tube should also be inserted on the least indication of colonic distention Low enemas of milk and molasses or of turpentine and glycerin may also be given after suitable intervals Constant application of hot

(3) Am J Surg 58 58 63 October 1942

If any blood, gas or intestinal contents are aspirated, the needle should be withdrawn immediately

One cc of the special vaccine diluted with 9 cc physiologic solution of sodium chloride is introduced into the peritoneal cavity The needle is withdrawn and the patient placed in Fowler's position for four hours During this period the pulse rate, blood pressure and temperature are determined half hourly After four hours, the patient is allowed up or permitted to lie down Codeine is given if necessary for cramps or pain Epinephrine should be available in case of allergic or anaphylactic reaction

To prepare the vaccine, a strain of Escherichia coli and a strain of green producing streptococcus obtained by culturing the peritoneal exudate of patients who had had fatal peritonitis are separately inoculated into bottles containing 150 cc of 0 2 per cent dextrose broth The bottles are incubated for 24 hours at 37 5 C and centrifuged The supernatant liquid is decanted, and 150 cc physiologic solution of sodium chloride is added to the centrifuged bacteria in each bottle The bottles are submerged in a water bath and kept at 70 C for one hour, the saline suspended bacteria are then mixed so as to have an equal quantity of Escherichia coli and green producing streptococci by volume, 0 3 cc of pure phenol is added and the mixture is thoroughly shaken

A series in which two vaccinations were utilized suggests that this method increases the efficiency of the vaccine in conferring immunity to peritonitis and that the procedure can be guided by postvaccinal rise of temperature after the first vaccination A plan that might be suggested is to include multiple intraperitoneal injections over six to eight days prior to operation Other studies, including that of Morton who accumulated data following intraperitoneal injection of solutions of sodium chloride, indicate that other solutions injected intraperitoneally may also be effective against postoperative peritonitis

Intra abdominal adhesions form when the serosae of two adjacent peritoneal surfaces are denuded and remain in contact for a sufficient time for an exudate to become organized and adherent to the two surfaces Distention of bowel with pressure exerted continuously between two adjacent intra abdominal visceral surfaces is

rapidly and is maintained four to six hours When sodium sulfathiazole or sulfanilamide crystals are placed in the abdomen at operation, there is a rapid high concentration of drug in the peritoneal exudate Blood concentration rises to therapeutic levels rapidly and falls below therapeutic levels after six hours

Further study may show that other soluble sulfonamides are preferable to sodium sulfathiazole When relatively insoluble sulfathiazole crystals are placed in the abdomen, effective concentrations are reached in the peritoneal exudate in 20 minutes and maintained for many hours The concentration in the blood rises slowly and usually remains below therapeutic levels

It is desirable to establish conditions unfavorable to bacterial growth in the abdomen as soon as practicable after injury and to maintain them until the perforation is closed and the natural defenses of the peritoneum have dealt with the contaminating organisms

A program for retarding the development of peritonitis after bowel perforation is suggested

PROCEDURE —One half gram of sodium sulfathiazole per 10 lb body weight should be injected intravenously as a 5 10 per cent solution in two to four minutes This is a first aid measure Intravenous fluid, plasma or blood should follow As an alternate procedure, a soluble drug or a suspension of sulfathiazole microcrystals may be injected directly through the abdominal wall, or in some cases through the entry wound

As soon as possible, laparotomy should be performed At that time, a relatively insoluble sulfonamide, such as sulfathiazole, should be placed in the abdomen When soluble sulfonamides are used in the abdomen, additional drug must be administered after eight hours When slowly soluble sulfathiazole is used in the abdomen, additional drugs need not be administered for 24 hours

T D Throckmorton[4] (Rochester Minn) studied the *peritoneal response* of white rats *to locally implanted crystalline sulfonamides* (sulfanilamide sulfathiazole sulfapyridine, sulfadiazine, sulfamethyldiazine and sul

(4) Surgery 1 906 918 December 1942

stupes (70 per cent alcohol, 95 cc, and glycerin, 5 cc) to the abdomen is of value in the relief of ileus

Behan treated 290 patients in whom adhesive formations were the principal pathologic change in the abdomen It was possible in 181 cases to obtain reports from 1 to 20 years after operation 136 patients were entirely free from symptoms for which they had been operated on, 37 were improved and 3 were not improved The five deaths which occurred were in no way contingent on the use of lanolin paste

[Not many surgeons nowadays believe that intra abdominal adhesions cause symptoms unless they are severe enough to produce intestinal obstruction —Ed]

Choice of routes for administration of sulfonamides in traumatic peritonitis was studied in dogs by Richard K. Gilchrist, Francis H Straus Russell Hanselman, Cecil C Draa Stanley E Lawron and Milnor Freeland[4] (Univ of Illinois), who also report on human material in which findings correspond to results found in their experiments

Sulfanilamide given by mouth after injury to the peritoneum will not produce adequate early concentrations in blood and peritoneal exudate A 10 per cent solution of sodium sulfathiazole may be injected intravenously without producing phlebitis Fifteen minutes after such an injection, the effective sulfathiazole level in the peritoneum will approach that found in the blood Therapeutic concentration in the peritoneal fluid will be maintained for four to six hours Fall in concentration will be hastened by giving intravenous fluid if circulation is adequate When soluble forms of drug are used an additional dose must be administered after eight hours if therapeutic concentrations are to be maintained

If sodium sulfathiazole solution is injected into the abdominal cavity after the injury and before closure of the perforation an immediate high concentration is obtained Blood concentration rises to therapeutic levels

(4) Surg Gynec & Obst 76 689 696 June 1943

rate from the blood is approximately that of these sulfonamides After intraperitoneal administration of 100 mg per kg body weight in dogs, the peak concentration is less than that reported for sulfanilamide and intermediate between that reported for sulfathiazole and sulfaguanidine However, peak concentrations are maintained longer with traces of the drug still present after 192 hours as compared with 48 hours for other sulfonamides similarly administered

In man, appreciable absorption of sulfadiazine is still evident 216 572 hours after intraperitoneal or local administration, as compared with only traces of the drug 48 hours after oral or subcutaneous administration of a single dose of 5 Gm After cutaneous application of sulfadiazine spray on burns, absorption is more rapid and blood concentrations are higher than those observed after intraperitoneal administration or local application in wounds This is particularly evident during the first 90 hours of treatment after which blood concentrations rapidly fall to approximately 2 mg per 100 cc, at which level they remain even though spraying is only continued occasionally

These experiments suggest that sulfadiazine intraperitoneally is more ideally suited for a prophylactic agent in prevention of postoperative infection than other sulfonamides since it is more slowly absorbed, so that more of the drug remains in situ to produce a more lasting bacteriostatic effect These results also suggest that reenforcing the local treatment with oral administration of sulfadiazine or other sulfonamides whenever indicated may well be undertaken particularly in patients in whom sulfadiazine is used within the abdominal cavity or in wounds, provided the usual precautions for these drugs are followed

J Sutton Regan, S Sanes and James D MacCallum[6] describe seven cases of *so called retroperitoneal lipoma*

(6) Ann Surg 117 110 117 January 1943

famylguanidine) Each drug produces some peritoneal reaction, as mirrored in cellular changes in the peritoneal fluid These reactions, ranging from meager response to sulfanilamide to violent responses induced by sulfapyridine, are nonspecific and depend on a foreign body reaction of the tissues toward the drug itself as well as on the innate irritant properties of certain of these compounds The relation of this local tissue response to the efficacy of sulfonamide therapy is stressed The drugs owe their therapeutic value to properties of bacteriostasis, actual killing and disposal of the attenuated bacteria are performed by the local cellular defense mechanism Augmentation of peritoneal cellular defenses by these drugs in local application is of great value, complementing as it does their bacteriostatic properties However, the vigorous response initiated by certain of the compounds, especially sulfapyridine, walls them off from the general peritoneal cavity so rapidly as to reduce their effectiveness as bacteriostatic agents Of the compounds used, it seems that sulfathiazole has certain advantages as an intraperitoneal chemotherapeutic agent (1) it is active against a variety of micro organisms, (2) it is innocuous to the peritoneum, (3) it exerts a prolonged bacteriostatic effect, and (4) it stimulates the local cytologic defense mechanism to an effort the equal of any inspired by usual methods of peritoneal vaccination

Absorption of Sulfadiazine after Oral and Intraperitoneal Administration in Dogs and after Intraperitoneal and Local Administration in Man —Experiments of A M Ambrose R Arnold Griswold and Joseph E Hamilton[5] (Univ of Louisville) on dogs after oral administration of 100 mg sulfadiazine per kg body weight indicate that the degree of absorption of this drug is less than that reported for sulfanilamide, sulfathiazole or sulfaguanidine and that its disappearance

(5) Am J M Sc 05 3 6 383 March 1943

displacement and obstruction of stomach and duodenum

Diagnosis of retroperitoneal lipoma was not made preoperatively Retroperitoneal tumor was the clinical impression in three patients, incisional hernia in one ovarian cyst in two and fibroid uterus in one

Six patients were operated on by the transperitoneal route The tumor could be removed in four In one of these, along with the tumor, the cecum, ascending colon and appendix had to be excised because of injury to blood supply, in another case, the kidney and portion of the adrenal had to be extirpated with the tumor Factors which apparently influenced operability were size, encapsulation and absence of incorporation with vital organs

Of the four patients in whom the tumor was extirpated three recovered Two developed drainage from the wound The fourth patient died three days after operation (excision of cecum, ascending colon and appendix suturing of duodenum) with fever, stupor and respiratory symptoms Three patients who had had celiotomies but without removal of the retroperitoneal tumor, died 10 13 days following operation Autopsy showed primary causes of death to be (1) peritonitis from perforation of cecum, (2) rupture of heart from myocardial infarct, and peritoneal abscess in connection with sinus into duodenum, and (3) pulmonary aspiration of gastric content No patient received pre or postoperative radiation

Mesentery—Having seen two cases of intestinal obstruction from herniation of the small intestine through an *aperture in the mesentery*, J S Robison[7] (Winchester) reviewed the literature Most writers believe that congenital defects are responsible for development of mesenteric apertures through which the bowel may pass and become strangulated Trauma also has been established as a possible cause Most observers hold that inflammation rarely if ever directly causes the condi

(7) J Indiana M A. 35 295 303 June 1942

observed at Buffalo General Hospital Ages ranged from 41 to 83, average 58 There were five females and two males

All the tumors were in the retroperitoneal tissue above the pelvis In two, however, the tumor was thought to have originated in the pelvic cavity The right side of the abdomen was involved six times Five tumors were of the single type In two patients, the lesion was multiple Projections were given off from the main mass in two The tumors were usually demarcated from surrounding tissue, lobulated, yellow to yellow gray and of varied consistency Edema, pseudocyst formation, myxomatous changes, inflammation and hemorrhage were frequent Average weight was 15 lb The largest tumor extended from diaphragm to pelvis Tumors produced compression and displacement of liver, colon duodenum, stomach, kidney, ureter and inferior vena cava Frank sarcomatous lesions were present in three cases, in two which came to necropsy, metastases were not found

Four patients complained of symptoms directly referable to the tumor Presence of a mass and gradual progressive enlargement of the abdomen was the commonest complaint One patient had sharp pain, apparently due to subcapsular hemorrhage in the lipoma

Three patients were not aware of the tumor until discovery by a physician who was consulted for (1) coronary occlusion, (2) incisional hernia and (3) hypertension Symptoms, on the basis of compression of adjacent organs by the tumor, included edema of legs dyspnea and vomiting History of weight loss was elicited in two cases In one, a "fatty tumor" had been removed previously Five patients showed enlargement of the abdomen A definite nontender mass which did not move on respiration was palpated four times Percussion note over the mass was dull or tympanitic

Roentgen studies were made in four cases Pyelograms revealed displacement of kidney and ureter in two In the other two, gastro intestinal study disclosed

sure were exerted against the colon, its position might be influenced, it might swing to the left of the small intestine instead of crossing the duodenum as it normally does Continuation of pressure as the intestine migrates into the cord might cause the colon to continue along the path of least resistance and gradually force its way through the delicate structure of the mesentery The fact that nearly all the openings in the mesentery occur in the same position i e, close to the ileocecal junction, makes Judd s explanation a likely one

A number of cases reported in young children, while not stated to be congenital, presented histories of recurrent attacks of abdominal pain and distress which would lead to the assumption that they were congenital It seems logical therefore to conclude that congenital defects are the causative factors in most cases

Various types and sizes of openings were found, 1 10 cm in diameter Edges of the ring are usually thickened and enlarged lymphatic glands noted in the root of the mesentery at the point of defect Since many of the cases described have mesenteric arteries in the edges of the ring covered by indurated, smooth peritoneum care should be exercised not to injure or ligate these vessels in closing

The gross pathology of the strangulated bowel is the usual process of tissue death due to obstruction of blood supply, with a large amount of extravasation of blood both in the lumen of the bowel and into the peritoneal cavity Chronic partial obstruction may greatly influence the nutritional state Symptomatology in this type of obstruction varies little from that produced by obstruction from other causes Attention has been called to dietetic indiscretions Onset is sudden and the patient becomes rapidly and critically ill Generalized abdominal cramping pain is usually the first symptom Vomiting soon follows, and the higher the obstruction the earlier and more persistent is this symptom Vomitus may consist of recently ingested food later becoming

tion In a large percentage of cases the defects were found in the mesentery of the terminal ileum, but they may be in almost any portion of the mesentery of the small and large bowel Massive resection may be necessary in dealing with this type of obstruction After one loop of intestine has passed through an opening in the mesentery, more and more of the bowel tends to work itself through as the result of intra abdominal pressure and peristalsis Because of extensive involvement and rapid changes in blood chemistry, the patient becomes critically ill Therefore mortality has been high in cases reported as having had primary resection The importance of early recognition of obstruction and operation cannot be emphasized too strongly Robison believes that when a few feet of nonviable intestine must be excised, exteriorization and establishment of a complete external fistula, followed by secondary anastomosis at an opportune time, carries less risk for the patient In unusual instances necessitating a high fistula or an extraordinary sacrifice of intestine, it is better to assume the risk of primary resection

Exteriorization was not used in many of the cases reviewed Watson performed primary resection of the bowel, anastomosis and a Witzel enterostomy proximal to the anastomosis, with recovery

Judd believes congenital defects are the cause in most cases and is the only writer to offer an explanation for their occurrence He points out that according to Mall, the greater portion of the intestine is forced from the abdominal cavity into the celom of the umbilical cord by the rapidly growing liver between the seventh and tenth weeks of fetal life After the tenth week the intestine normally returns to the enlarged abdominal cavity Judd believes that the opening in the mesentery is caused by pressure rather than actual lack of tissue The displacement of the greater part of the gut from the abdominal cavity into the umbilical cord indicates that considerable pressure is required If sufficient pres

X rays may be of some value in diagnosis Flat plates may be made while other tests are being performed For obvious reasons opaque meals should never be used Both anteroposterior and lateral views are helpful Lateral views are sometimes helpful in locating fluid levels and gas pockets Anteroposterior views are made with the patient both in prone position and lying on one side True anteroposterior films frequently show the typical stepladder markings produced by distended loops of small bowel In massive strangulation, little gas or characteristic markings may be noted The colon can usually be outlined from small accumulations of gas

Early recognition of this type of obstruction is extremely important as a life saving measure Some not considering that intestinal obstruction is ever an emergency, advise hospitalization, decompression of the stomach by the Wangensteen method or use of the Miller Abbott tube which passes into the bowel and in many instances down to the obstruction Blood chemistry is checked carefully and fluids are administered parenterally, transfusions of whole blood, plasma and particularly chlorides are given This method frequently changes the entire clinical picture One can hardly hope to relieve this type of obstruction completely by this method, however, the general condition may be definitely improved and a poor risk patient may be made a fair surgical risk, particularly if exteriorization is done followed later by anastomosis

Massive resection may be necessary Removal of large amounts of the small bowel certainly disturbs metabolism Watson analyzed 73 cases of extensive resection of the small intestine 41 with 6 ft 7 in to 9 ft 10 in resected, 26 with 9 ft 10 in to 13 ft 2 in resected 6 with 15 ft 8 in to 17 ft 9 in resected Six of the 73 patients died of marasmus in 25 days to 2½ years Of these six the one with the largest resection lived the longest time These figures give an idea of the safety margin in resections Even though a large amount

definitely fecal Enemas may remove some fecal material and a small amount of gas from the colon, but usually the bowel is completely locked, and frequently the solutions only add to discomfort Distention may not be present for a few hours but as the pathologic process progresses this symptom becomes more apparent In children, outline of the coils of the intestine may be evident through the abdominal wall The greatest amount of distention is noted in one of three main locations, depending on the point of obstruction If in the terminal ileum, the greatest amount of distention will be in the right lower quadrant If high, involving the first part of the jejunum, the greatest distention will be in the left upper quadrant If in the midportion of the small bowel, distention is more likely to be in the epigastrium and around the umbilicus

As a result of continuous vomiting, pain and changes in blood chemistry, the patient presents definite symptoms of shock rather early Tenderness and rigidity are present over the entire abdomen, particularly over the point of obstruction Some observers have detected a definite mass on palpation The blood picture shows some degree of secondary anemia, however, red cell count may be increased owing to reduction of plasma volume There is leukocytosis with a shift to the left

Changes in blood chemistry are attributed partly or wholly to dehydration Dehydration also causes increased tissue destruction with resultant impaired kidney function This combination of circumstances is largely responsible for the marked increase in concentration of the nonprotein nitrogen of the blood, which returns to normal after obstruction is relieved Another theory concerning increase of nonprotein nitrogen is that kidney function is impaired by some circulating toxin produced in the obstructed loop of bowel Urine is concentrated and highly colored and shows some albumin A few renal cells and granular casts, with some pus cells, are found microscopically

genographically and confirmed at operation The tumor was found in the mesentery of the jejunum, and no metastases could be discovered Nevertheless, the patient died of metastatic involvement 21 months after operation Apparently, neurogenic sarcomas of the mesentery differ from those occurring along peripheral nerves in that the latter possess a far greater tendency to give rise to metastases

Although neurogenic sarcoma may occur anywhere in the body, it is infrequent in the abdominal cavity and rare in the mesentery Only four mesenteric cases have been reported in the literature since 1909, and none was a solitary tumor at the time of surgery

Omentum—Roland W Jones[6] (Newark, O) reports a case of *primary cyst of the greater omentum* in a boy, 3, who presented the hyperpyrexia that so often follows operation on young children and who also had a severe blood transfusion reaction from which he died Study of the development of the omentum would lead to belief that cyst formation would be no more uncommon than hydrocele of the spermatic cord However the condition is rare as attested by Horgan who, in a review of the literature in 1935, listed 97 cases In 1939, Guernsey reviewed the 20 cases seen at Mayo Clinic from 1907 to 1938 and including 2 lipomas

The typical structure of these cysts includes a fibromuscular wall, often lined with a layer of endothelium and containing clear fluid They may be found free from adjacent structures in the peritoneal cavity, developing in the potential spaces between the leaves of the greater omentum They vary greatly in size may be single or multiple and have occurred most frequently in children and young women

Symptomatology varies greatly, according to size and location of the cysts presence of adhesions to adjacent viscera or to the abdominal wall or occurrence of hemor

(6) Ohio State M J 39 331 333 April 1943

of bowel must be sacrificed in some cases, marasmus may be avoided by careful attention to dietetic measures and vitamin therapy

In Robison's first case, 8 ft of gangrenous bowel and involved mesentery was removed and a lateral anastomosis done, with a Witzel enterostomy proximal to the anastomosis, the original incision being used for exit A small Penrose drain was placed in the peritoneal cavity at the site of the anastomosis The opening in the mesentery through which the bowel had passed, located in about the middle portion of the ileum, was about 3 cm in diameter and roughly circular The edges of the aperture were smooth and showed no evidence of recent injury

In the second case the right colon had failed to rotate and was lying internal and anterior to the descending colon The entire small bowel had passed through an aperture in the posterior layer of the mesentery of the small bowel at the point where it crossed the spine The small bowel entered this aperture and crowded the anterior layer up and to the right, giving the appearance of a cyst There was marked inflammation in the last loop of bowel that had just entered the aperture Recent adhesions were noted between bowel wall and mesentery The bowel at this point showed some congestion and a few rather dark spots about 1 cm in diameter, but in the main the entire bowel circulation was good and no resection was necessary The small intestine was withdrawn from the sac and the aperture sutured Both patients are well

Morris J Shapiro and Morris Horwitz[5] (Michael Reese Hosp, Chicago) report the first case of *solitary neurogenic sarcoma of the mesentery* The patient presented none of the other stigmas of Recklinghausen's disease The preoperative diagnosis of cystic tumor communicating with the small intestine was made roent

(5) Am J Surg 61 1 ? 135 July 1943

the spermatic cord One can imagine areas of greater omentum where fusion did not occur and, with slow accumulation of fluid, a resulting cyst

Donato Viggiano and Louis Iacueo[8] (Columbus Hosp , New York City) used *free omental grafts to correct and prevent intestinal adhesions* in three cases

CASE 1—Man, 45, had a mass in the pelvis consisting of several loops of adherent ileum It was gently separated from the bladder and sigmoid, and the adherent loops of ileum were freed The involved ileum was about 12 in long and practically devoid of serosa Seven pieces of free omental graft, ranging from 1½ to 3 in in size, were applied to the raw surfaces of the ileum, bladder and sigmoid to avoid recurrence of adhesions The patient made an uneventful recovery and 20 months later had no signs of intestinal adhesions

CASE 2—Woman, 21, had an appendectomy three years before admission and an operation for gallbladder symptoms three months before The gallbladder was found to be normal, but there were adhesions about the cecum which were removed Present admission was for intestinal adhesion When the abdomen was opened, the cecum and ascending colon were found plastered against the peritoneum and were inadvertently cut through the serosal and muscularis coat, an area 3×7 in being denuded before the error was realized A free omental graft was applied over the denuded portion The patient has had no complaints since the operation one year ago

CASE 3—Youth, 17, was admitted for intestinal obstruction At operation the jejunum was found bound down at the postabdominal wall by a large adhesive band After the jejunum was released it was found that the serosal and muscularis coats originally beneath the adhesion were completely destroyed To avoid resection of this portion of jejunum a free omental graft was applied to the denuded area The patient made an uneventful recovery and has been well for the past five months

Free omental grafts were also used by John Lucius McGehee[9] (Univ of Tennessee) in 15 patients with various degrees of adhesions 9 had had previous operations and 6 had not The entire group has remained well and free from symptoms so that there has been

(8) Am J Surg 58 121 122 October 1942
(9) J Missouri M. A. 39 284 287 September 1942

rhage into the cyst According to Horgan, symptoms are caused by "pressure, torsion, traction," and he lists them as "nausea, vomiting, anorexia, constipation or diarrhea pain dysuria, frequent micturition" Some cysts cause no symptoms Complications may be present due to size relations and site of the mass, manifesting circulatory, functional or traumatic effects on adjacent structures or excited by degenerative changes within the cyst Of the series reviewed by Guernsey, 11 were incidental findings at laparotomy or autopsy and had produced no symptoms

Treatment is surgical, preferably excision, unless adhesions to contiguous viscera prevent it In massive cysts removal is facilitated by aspiration of the fluid contents When the adhesions do not permit a one stage procedure exposure and fixation to the anterior abdominal wall followed by drainage are necessary

Because of the rarity of the condition, diagnosis is difficult Some cases may first be noticed because of the increasing size of the abdomen, which has sometimes reached tremendous proportions before causing symptoms As the symptomatology is influenced by the size, location and contiguity of various abdominal structures, the diagnosis of omental cyst is rarely made The differential diagnosis includes ascites, ovarian cyst, tuberculous peritonitis mesenteric cyst gallbladder, stomach, liver or kidney disease pancreatic cyst, neoplastic or parasitic lesions primary or metastatic malignancy, etc

As to the cause of the formation of omental cysts Guernsey favors the postinflammatory theory of pathogenesis, while Montgomery and Wolman believe in a neoplastic origin

Several omental cysts have been reported in which there is definite evidence of neoplastic growth with hyperplasia and hypertrophy of the endothelium, development of new lymph vessels and, in some cases formation of solid strands of endothelial cells Probably some are formed after the same manner as simple hydrocele of

If the forceps should slip off, it can easily be reapplied If this happens, it will be after the pin has been ro tated The ring end of the pin can then be grasped and the pin removed without difficulty

3 This method at no stage violates the principle of the after trailing point, so that there is no danger of perforation

4 It is not necessary to go down after the point or the ring of the pin Figure 85 shows the usual position of the safety pin in the esophagus The keeper shaft of the pin lies nearly parallel to the esophageal wall, while the pointed end lies at an angle to it and below the

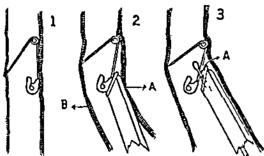


Fig 85 —*1* usual position of open safety pin in esophagus *2* bringing of pin into proper position for the method *3* application of forceps

keeper It is this fact which makes the method appli cable Any attempt to pass the esophagoscope down far enough to grasp the point or ring necessitates by pass ing the keeper end This is likely to dislodge the pin, causing it to disappear into the stomach as happened in one case

5 No special instruments are required

Method —The principle involved is making use of the bev eled end of the esophagoscope, both for application of the forceps and for rotation of the pin The esophagoscope is introduced in the usual manner until the keeper of the pin is sighted then the esophagoscope is rotated through an arc of 90 degrees (Fig 85 *2A*), so that the keeper fills its entire field At this point, if necessary, the keeper can be displaced toward the midline of the esophagus by slightly adducting the head and neck (Fig 85 *2B*) toward the shoulder of the

no opportunity to examine the grafts As clinical reports on the ultimate fate of the free omental graft in man are still too meager, it seemed advisable to repeat the original experiments of Senn on dogs to obtain some light on the subject

In five dogs the grafts were attached to unharmed ileum and in another five to scarified ileum Examination three months later showed that the results are better when the surface to which the graft is applied is thoroughly scarified When normal peritoneal surface (unscarified) is used as a base the graft does not take but becomes enveloped by the intact omentum This confirms the findings of Senn

f

ESOPHAGUS

Foreign Bodies—Paul G Bunker[1] (Aberdeen, S D) presents an easy *method of rotating an open safety pin in the esophagus* which he has found successful in seven patients aged 4 months to 24 years, and in dogs The method has numerous advantages

1 The distal end of the esophagoscope is brought into proper relation with the keeper end of the pin, and the forceps can easily be applied blindly To do this, the blades of the forceps are spread inside the esophagoscope as it is inserted so as to impinge against the inner wall It can then be felt to slide out the distal end of the esophagoscope and it is necessary only to overbite the forceps the estimated distance to engage the pin properly The instrument used for this purpose is the ordinary flat, forward grasping forceps (Chevalier Jackson model) with the serrated grasping surface (Figs 85 and 86)

2 The procedure can be done in one stage i e, the pin can be rotated and withdrawn in one manipulation

(1) Arch Otolaryng 37 78 81 January 1943

tip of the esophagoscope to prevent the pin from slipping off the end of the instrument, as the pin is rotated Practically, it is not needed

If the pin is lodged in the cricopharyngeal region, it may be more easily rotated, after proper application of the forceps, by lowering the pin into the thoracic portion of the esophagus where there is more room to carry out this manipulation

Carcinoma —About 5 per cent of all malignant disease occurs in the esophagus, with the proximal third involved in 18 4 per cent (Watson) Experience with radiation therapy has given no encouragement, and surgery has afforded the only hope of a cure Therefore the surgeon must do all in his power to establish an earlier diagnosis

William A Hudson[3] (Detroit) reports two cases of carcinoma of the proximal portion of the upper third of the esophagus which illustrate the value of complete removal of the lesion and the disappointment that can follow anything short of complete removal The lesions are so intimately associated with the larynx or involve it in such a manner that both esophagus and larynx must be removed if a cure is to be expected

The cases presented almost identical problems, in both the common partition was involved to such an extent that removal of the esophagus or larynx individually was not sufficient to eliminate the cancer in its entirety In the first case, extensive but clean removal of the lesion resulted in recovery, and the patient was well over three years after the operation In the second case, with a somewhat less advanced lesion, failure to remove the larynx resulted in failure to cure

Metastatic involvement of the regional lymph nodes occurs late simplifying the surgical problem considerably Careful roentgen and endoscopic studies should be made in all patients who complain of distress of any sort on swallowing If at first no explanation for the discomfort can be found repetition of the studies

(3) Ann Otol. Rhin & Laryng 51 1125 11 9 December 1942

keeper side, the tip of the esophagoscope, used as a gentle lever (Fig 85 *2*), then brings the pin into the proper position The forceps is now applied (Fig 85 *3*) Application of the forceps at any point between the keeper and the ring of the pin is satisfactory for carrying out the manipulation It is important to overbite the keeper shaft, so that the pin is engaged between the shanks of the forceps and not between the grasping surfaces (Fig 85 *3 1*) This allows the pin to rotate freely within the shanks The grasping surface serves merely as a guard to keep the forceps from slipping off the pin

The esophagoscope is now rotated through a 180 degree arc, which reverses the relative position of the beveled end of the esophagoscope (Fig 86 *1A* and *2A*) Downward pressure

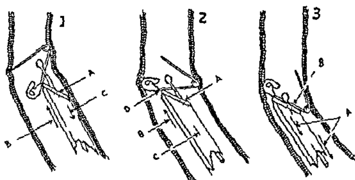


Fig 86 —*1* rotation of esophagoscope around forceps *2* rotation of pin around tip of esophagoscope through counterpressure with tip of esophagoscope and traction with forceps *3* position of pin after rotation

sure is brought to bear on the keeper of the pin (Fig 86 *1B* and *2B*) with the tip of the esophagoscope while traction is made with the forceps (Fig 86 *1C* and *2C*) This rotate the pin around the beveled end of the esophagoscope (Fig 86 *2D*) Figure 86 *3* shows the position of the pin after rotation in which position the pin, esophagoscope and forceps can be safely withdrawn (Fig 86 *3 1*) without reapplying the forceps This is done by holding the pin snugly against the beveled end of the esophagoscope as it is withdrawn (Fig 86 *3B*)

If the pin is not found in the position described in Figure 85 *1* and cannot be brought into this position by using the tip of the esophagoscope the keeper of the pin can be grasped with the forceps and gently drawn up into the proper position for this method A second application of the forceps would be required to proceed with the rotation

Theoretically it seems logical to have a notch placed in the

the cervical wound that air is not sucked into the chest and retained Here also the wound is rendered finally airtight during full expiration Coughing should be prevented until the underwater drain has had time to evacuate most of the air in the pleural cavity

For growths of the lower third, an isolated jejunal loop seems necessary to make satisfactory anastomosis between skin and stomach For growths of the middle third, Wookey advocates use of the lower end of the esophagus for this purpose When possible, junction of esophagus above with jejunum or esophagus below should be done in one stage

In one case a jejunal loop was isolated when a jejunostomy was done, before the esophagus itself was removed Emphasis cannot yet be laid on the importance of this step It may delay the date at which the growth can be removed as it adds greatly to the magnitude of the abdominal operation

In a patient in whom a successful esophagectomy has been done, but whose progress has still to be watched, he followed Turner's advice and removed part of the inner end of the left clavicle to make a groove for the esophagus As a result retention of a rubber tube has been much easier and he is convinced of the importance of this step

R H Franklin[5] (Brit Postgraduate Med School) *successfully removed the thoracic esophagus for carcinoma in two cases* Both patients made uneventful recoveries but had some difficulty in managing their extrathoracic tubes Leakages may develop unexpectedly, and it is not always easy to obtain tubes of just the right degree of softness

The first patient has remained in good health, is able to do her housework and can eat ordinary food The second patient died 13 months after operation At autopsy he was found to have local recurrences in the

(5) Brit J Surg 30 141 146 October 194

may later reveal the real cause to be carcinoma Then the lesion should be removed completely without further delay

P R Allison[4] (Leeds) describes *four cases of esophageal carcinoma treated by excision* of the thoracic esophagus in three and of the stomach and abdominal esophagus in one The four patients survived operation but none lived longer than a year The fourth case presents perhaps more pathologic interest, for it must rarely be necessary to treat esophageal carcinoma by gastrectomy Malignant tumors in this region which cause dysphagia are usually of gastric origin

From the other three cases, certain technical lessons have been learned which are worthy of emphasis Preliminary mobilization of the esophagus from the neck is of great help The approach to growths in the middle third of the esophagus should be through the right pleural cavity, but for the lower third the left side gives better access Division of the esophagus by first incising the muscular coat, then separating it by blunt dissection from the mucous coat and crushing and ligating has proved a satisfactory method which permits invagination and overstitching of the blind ends Use of sulfanilamide powder in the mediastinum gives a great feeling of safety

No attempt is made to suture the mediastinal pleura, so serum has easy access into the pleural space Drainage tube is perforated and long enough to drain both mediastinum and pleura It has an underwater seal and is left in place 48 hours The tube is inserted before the chest wound is closed, so that risk of surgical emphysema is minimized To the same end, the lungs are allowed to inflate against about 10 mm positive pressure for half a minute before the last stitch closes the chest, and this stitch is drawn tight at the end of expiration Care must be exercised during the last stage of closing

(4) Brit J Surg 30 13° 141 October 194

forming a channel of whole thickness skin with its subcutaneous tissue, arranged to include the fistula in the neck, and then to cover the raw surface of this channel and the raw surface made by its formation with other whole thickness skin and subcutaneous tissue brought in by means of tubed flaps

The first attempt to make a single long tubed flap on the right side to supply the entire covering for the extrathoracic esophagus was not successful, therefore, only a portion of the original long tube was eventually available after one pedicle had been cut, making it necessary to use two tubed

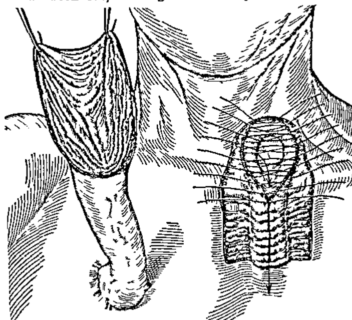


Fig 87 —Position of incision through skin and subcutaneous tissues including fistula in the neck and method of forming the skin channel Margins inside the incision were drawn together with sutures forming upper portion of new skin lined channel Posterior pedicle of tubed flap had been divided all scar tissue removed and a suitable portion opened.

flaps instead of one The free end of the tube was opened 3-4 cm and all scar tissue excised The opened end was carried across the chest wall toward the midline as far as its pedicle would allow At this point a crescent shaped incision about 4 cm long with its curve toward the midline, was made and the included flap of skin and subcutaneous tissue was turned outward making a more or less circular raw surface into which the opened out free end of the tubed flap was utured carefully

mediastinal lymph nodes but no generalized metastases

The author insists on the advantages of approaching the esophagus from the right side of the thorax

[The approach through the right pleural cavity as advocated also by Ochsner is certainly easier because it obviates the difficulty caused by the presence of the arch of the aorta —Ed]

Technic—Laurence Miscall and Bliss B Clark[7] (New York City) report two cases of satisfactory use of the *Murphy button in esophagogastrostomy* for cancer of the lower third of the esophagus One death occurred from extrapleural infection

If the button is used, its line of anastomosis should be re enforced by adequate serosal covering without tension at the site of suture Silk sutures throughout are probably necessary The button not only provides a tight non leaking anastomosis while adequate adhesions form but also insures a patent lumen which allows early oral administration of fluids The spontaneous opening of the stomach which had been closed with catgut in one case emphasizes the importance of adequate closure, which can best be accomplished with the exclusive use of silk sutures

Successful construction of an extrathoracic esophagus is reported by John Staige Davis and Edward S Stafford[8]

Girl, aged about 3 years, swallowed concentrated lye, with resulting progressive stenosis of the esophagus, for which gastrostomy was done Complete cicatricial closure of the esophagus became evident and during the next 18 months she had repeated attacks of aspiration pneumonia, complicated twice by empyema and did not gain in weight An external esophageal fistula was made just above the medial end of the left clavicle it was later made permanent by turning in and attaching skin flaps to the esophagus wall No further attacks of pneumonia occurred, and a rapid weight increase took place Further operative procedures were postponed because it was not known what effect growth might have on a reconstructed esophagus When the patient was 15 it was decided to construct an extrathoracic esophagus by

(7) Surgery 14 83 87 July 1943
(8) Bull Johns Hopkins H sp 7 101 1? October 1942

In due time, the pedicle attached to the anterior portion of the chest wall was separated, and the tubed flap was opened and spread out for its full length An additional portion of the channel continuous with that first made was formed in the same general way and the opened out tubed flap was sutured to the skin, thus covering it This made a channel continuous with the fistula in the neck and about half as long as was necessary to complete the extrathoracic esophagus Another tubed flap was made on the left side of the thoracic wall, and, when ready, its lower pedicle was cut and sutured into a curved incision on the anterior portion of the chest wall When conditions were favorable, the posterior pedicle was divided When the free end of the flap was brought to the midline in anticipation of covering the next section of the channel in continuity, it was found that its application at that point would interfere with its circulation Thus it was necessary to construct the portion of the channel adjacent to the gastrostomy opening first This was done in the usual way When the pedicle on the chest wall was finally separated, the portion of the channel between the areas previously made was completed by the same type of procedure, and the channel extending from the neck to the costal margin was completely formed All these procedures took about one year Finally the extrathoracic esophagus was ready for its hook up with the stomach

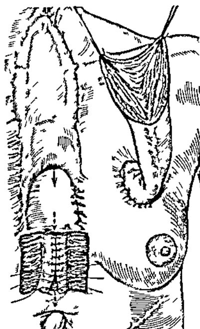


Fig 89 —Tubed flap on the left side opened and scar tissue removed after separation of its posterior pedicle Because of circulatory disturbance it could not safely be brought over to cover the skin channel if formed in continuity Lowest portion of channel was then formed first in the usual way and the opened out tube was used to cover it

The abdomen was entered by a left paramedian incision, the upper end of which terminated 4 cm below the end of the extrathoracic gullet A segment of jejunum 20 cm. long was selected for transplantation, this portion commencing about 10 cm below the ligament of Treitz and having a long, mobile

Subsequently the tubed flap was lengthened posteriorly for 7 to 8 cm One month later, the posterior pedicle of the flap was divided, and after removing the scar, this portion of the flap was opened and flattened for about 7 to 8 cm. Two vertical parallel incisions about 7 cm apart and 10 cm long were then made so that the fistula in the neck was midway between their upper ends These ends were joined by a curved incision extending above and including the opening into the neck At the inner side of the lower end of each parallel incision an incision 2 cm long was made at right angles to

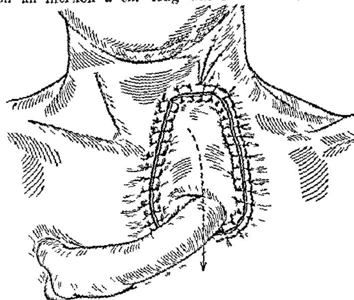


Fig 88 —Upper section of skin channel and opened out portion of the tubed flap placed over it This was sutured into position with on end mattress sutures note direction of arrow

facilitate formation of the channel After mobilization of the margins of the tissue inside these incisions, leaving the base intact, the edges of skin were sutured to each other with interrupted 000 chromic catgut tied inside and supplemented with other sutures in the subcutaneous tissue, thus forming a channel lined with whole thickness skin with its subcutaneous tissue attached This channel included the neck fistula in its upper part and was continuous with it The opened out portion of the tubed flap was brought over and sutured with fine black waxed silk and horsehair into the raw surface over the channel, thus closing the entire defect without tension and making an external covering of skin and subcutaneous tissue for the newly formed channel as far as it had been made

row of interrupted 0 chromic catgut end on mattress sutures The edges of the relaxation incision could now be approximated without impairing circulation, and a small rubber drain

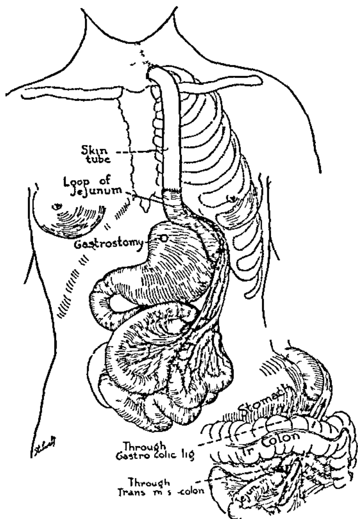


Fig 91 —Completed reconstruction Transverse colon is omitted from large drawing for sake of clarity

was inserted into the lower angle The skin overlying the extrathoracic gullet was approximated to the upper end of the skin channel and the skin of the abdominal incision was closed completing the reconstruction

mesentery Stone intestinal clamps were used, the bowel was divided and the mesentery incised nearly to the root, care being taken to preserve the circulation of the isolated segment The isolated intestine and its mesentery were placed to the patient's left and intestinal continuity was re established by end to end anastomosis of the upper and lower portions of the jejunum The defect in the mesentery was closed

Openings were made in the mesocolon and gastrocolic omentum well to the left of the midline The isolated segment of jejunum was brought through these openings into a position in the upper left abdomen adjacent to the cardia of the stomach Care was taken to prevent rotation of the mesentery of this segment The clamp was removed from the caudal end of the transplanted jejunum, and an "open" anastomosis was carried out between the anterior wall of the stomach and the end of the bowel The anastomosis was placed as high as possible on the stomach, its performance was made difficult by fixation of the stomach wall due to the proximity of the gastrostomy opening

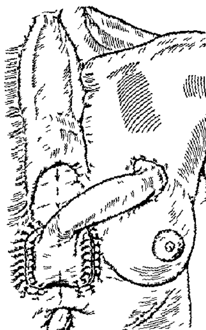


Fig 90 —Lowest portion of the channel formed and covered with opened out portion of the tubed flap

The cephalad end of the jejunal segment was brought out of the abdominal cavity through the upper angle of the abdominal incision The lower portion of the incision was then closed A tunnel was made under the skin from the upper angle of the abdominal incision to the lower end of the extra thoracic gullet The end of the inner skin channel was separated from its bed The jejunum was passed through the tunnel and the excess jejunum amputated Since the jejunal circulation was impaired by compression of the overlying skin a relaxation incision was made through the skin of the thoracic wall about 6 cm lateral to the tunnel This incision relieved the tension and the jejunal stump bled freely The ends of the jejunum and inner skin channel were approximated by a single

a cervical esophageal fistula and construction of the extrathoracic gullet, as it was not known what effect growth might have on a new esophagus Lundblad and Biezins carried out successful reconstructions in patients aged 2 or 3 years In Lundblad's patient, when observed at 19, the extrathoracic gullet functioned perfectly Several other patients have been observed for varying periods, and in only an occasional case has difficulty arisen, usually in the form of cicatricial stenosis at the junction of skin channel and jejunum This complication has been dealt with satisfactorily by bouginage

In connecting the skin tube to the stomach the superiority of the method which uses a segment of jejunum is unquestioned This portion of the gut joins readily and smoothly to either skin or stomach, with true healing It is doubtful whether gastric mucosa ever unites permanently with skin Development of a jejunal ulcer is not to be dismissed lightly, however, and although such is not yet reported, it will probably occur as frequently in a large series of cases as after other types of gastrojejunal anastomosis

In nearly every reported case fistula formation complicated wound healing, and when steps were taken to close the fistulas the results were not good Apparently such fistulas as develop will close spontaneously if permitted to do so

During the past seven years, 15 patients with *congenital atresia of the esophagus with tracheoesophageal fistula* have been admitted to the University of Michigan Hospital Thoracic exploration was done in nine The surgically ideal plan for correction of the malformation is reconstruction of the continuity of the esophagus by extrapleural ligation of the fistula and end to end anastomosis of the esophageal segments Cameron Haight and Harry A Towsley[8] report the first case successfully treated by this plan

(8) Surg Gynec & Obst 6 67 68? June 1943

Feeding through the gastrostomy tube was maintained for the first week, after which fluids were gradually given by mouth Within two weeks all feeding by tube was di continued Solid food, thoroughly chewed, was permitted 21 days after operation, and the patient has been on an un restricted diet since then She has been cautioned to chew thoroughly and to drink fluids after eating solid food

On the tenth postoperative day, two small fistulas developed at the site of the anastomosis between the extrathoracic skin channel and the jejunum They healed spontaneously at the end of two months Eight months after the final operation the gastro tomy opening had contracted considerably, but a the marginal lining of the gastric fistula was shown to be gastric mucosa by biopsy, it was doubtful whether complete spontaneous closure would take place in a reasonable time To expedite final closure the margins of the outer end of the fistula were mobilized and turned in, so that raw surface was sutured to raw surface and over the defect a flap of adjacent skin was shifted and sutured, thus closing the fistula

Studies were made of the function of the new gullet Following swallowing, air fluid and food pass down the skin channel rapidly and forcefully Active peristalsis can be observed in the jejunal segment, the contrac tion waves passing from above downward The position of the patient has little effect on the passage of ingested material The patient is leading a normal life eating with obvious relish and steadily gaining weight A roent genogram of the completed extrathoracic esophagus tak en after ingestion of bismuth shows a well formed chan nel from neck to stomach with a slight constriction at the point of anastomosis of the jejunal segment

Before undertaking reconstruction the esophagus should be explored from the gastric end as well as from above to make certain that it is not beyond repair As a rule, gastrostomy is performed initially as a life sav ing measure but even at this time the surgeon may facilitate reconstruction by locating the opening proper ly A convenient location would be some point along the left costal margin lateral to the mammary line

Ten years were allowed to elapse between creation of

hemostat with a blunt tip is a convenient instrument for this purpose The instrument is passed completely around the lower segment and a tape placed around it to provide tension for the dissection upward to the fistula The diameter of the segment should be carefully estimated, if it is only 3-4 mm, anastomosis should not be attempted, but the fistula should be ligated Gastrostomy and cervical esophagostomy would then be performed at subsequent operations In the authors' cases a contracted lower segment has been a greater obstacle to the performance of anastomosis than the distance between the two segments

Closure of the fistula is readily accomplished by a single silk ligature placed round the esophagus and tied as close to the trachea as possible A tension suture is placed in the wall of the distal segment which is then divided close to the ligature The lumen is cleansed with a mild antiseptic solution Packing off of the operative wound with gauze is not satisfactory because of the limited exposure The tension suture in the wall of the upper esophagus is held taut, and the blind end is opened to approximately the same diameter as that of the lower segment

The anastomosis is usually constructed in two layers with interrupted sutures of plastic silk on baby Emmet needles Approximately six or seven sutures that include all coats of the esophagus are placed in the first row A second layer of inverting sutures includes only the muscularis and the submucosa The anastomosis is more readily done over a catheter than without one If a catheter is used, it is removed after the anastomosis is completed A small soft rubber drain is placed in the lower angle of the incision and advanced to the region of the anastomosis to afford drainage if leakage should occur Closure of the wound is begun by approximating the anterior ends of the intercostal muscles to the under surface of the sacrospinalis muscle The extracostal wound is closed in layers, the closure being made securely around the drain to prevent the sucking of air into the extrapleural space The chest should be examined immediately following operation to be certain that a pneumothorax has not resulted from an unrecognized opening in the parietal pleura

Postoperative care includes prone position to prevent gravitation of oral and pharyngeal secretions into the trachea elevation of the foot of the bed for the same reason and to counteract operative shock conservation of body temperature oxygen tent codeine in frequent small doses prophylactic sulfonamide therapy and main

Operative correction of a tracheoesophageal fistula is not a procedure of the utmost emergency, it should be deferred until ample time has been allowed to get the infant into the best possible condition Usually at least one day, and occasionally several days, are required to accomplish this objective If fever is present the cause of the fever should be corrected before operation

Provision should be made in advance for administration of positive pressure by the anesthetic gases or oxygen in case the pleural cavity is inadvertently opened Local anesthesia with 0 25 per cent metycaine hydrochloride is used until separation of the parietal pleura is begun when light ether anesthesia by the drop method is started

Technic —With the patient in the lateral position, securely strapped to a frame and protected against chilling, a left vertical parascapular incision is made from the second to seventh rib Hemostasis is carefully attended to The trapezius and rhomboideus major are incised and the sacrospinalis is retracted mesially Lengths of 4 to 5 cm of the second to fifth ribs are resected back to their transverse processes The importance of avoiding opening the parietal pleura cannot be overstressed, because in infants the respiratory reserve is only slightly greater than the tidal air requirements

The intercostal muscles and nerves are next divided and the intercostal vessels doubly ligated and cut The periosteum is incised vertically after it has been separated from the parietal pleura The extrapleural separation is carried out slowly with a small blunt dissector An illuminated retractor is useful in maintaining the exposure The parietal pleura is freed until the posterior mediastinum is reached The left subclavian artery is retracted forward and to the right by the illuminated retractor

The blind upper end of the esophagus is usually readily found in the upper portion of the posterior mediastinum Its diameter is about 1 5 cm Its tip is secured with a tension suture Identification of the lower segment is often more difficult To gain adequate exposure of the segment the upper one or two intercostal arteries are doubly ligated and cut to allow the arch of the aorta to be displaced forward and down The diameter of the segment is usually about 6 mm

Separation of the lower segment from the trachea is begun about 1 cm below the fistulous communication A right angled

present being transformed into highly active carcinogenic agents in the body Experimental work has shown the relationship of sex hormones to carcinogenic substances and a possible mode of interchange from one to the other

Changes in blood content and activity of several hormones take place at the time when gastric carcinoma most frequently occurs The authors present the concept that the gastric mucosa is a gland and therefore liable to influences similar to those which control functioning of other endocrine glands There are marked differences in blood hormone content between the sexes Radical changes take place following involution These differences help explain the sex discrepancy and age incidence in gastric carcinoma and benign gastroduodenal lesions The authors believe relationship between the sex hormone control of the gastric mucosa and gastric pathology, including neoplasm, is actual and that further clinical and experimental work should be instituted to throw light on the problems of etiology, diagnosis and therapy of gastric carcinoma

By a standard physiologic method for study of factors affecting gastric secretion, Alexander Brunschwig, Richard A Rasmussen, Edward J Camp and Robert Moe[8] (Chicago Univ) have demonstrated the presence of a *gastric secretory depressant* in the dog's gastric pouch juice, in human acid gastric juice and in achlorhydric gastric juice from patients not having gastric cancer or pernicious anemia In view of previously recorded studies this factor appears to be present in lower concentrations in the foregoing types of juice than in the achlorhydric gastric juice of patients with carcinoma of the stomach or with pernicious anemia

Shock and Anesthesia in Transthoracic Gastric Surgery—In a series of gastric resections for carcinoma Henry K Beecher[9] (Boston) compares tolerance of pa

(8) Surgery 1 387 891 December 1942
(9) Surg Gynec. & Obst. 76 331 3 6 March 1943

tenance of suitable ascorbic acid blood level by daily injections Fluids consisting principally of 5 per cent dextrose are given subcutaneously, care being taken to prevent overhydration A transfusion of whole blood or plasma should be given as a supportive measure when indicated to prevent depletion of serum proteins Parenteral fluids are continued until an adequate formula can be given by mouth or until it is ascertained that a gastrostomy will be needed because of leakage

Roentgen examination of the esophagus should precede administration of fluids by mouth

An important cause of death is bronchopneumonia from a spill over of pharyngeal secretions into the tracheobronchial tree Intermittent pharyngeal suction is indicated as soon as pharyngeal secretions are evident and bronchoscopy may be needed for aspiration of the secretions Pleural effusion of sufficient amount to require thoracentesis may occur on the operative side as a result of the extrapleural operation

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STOMACH AND DUODENUM

Gastric Mucosa as an Endocrine Gland—Robert H Abrahamson and J William Hinton[7] (Bellevue Hosp) observe that clinical surgical and experimental studies for early diagnosis and therapy in gastric carcinoma have been largely unsuccessful Two established and unexplained facts are age incidence and sex discrepancy

Effects of vitamins on gastric mucosa as well as elsewhere are partially due to their relationship with and effect on endocrines

Experimental work shows that the gastric mucosa can be influenced by hormone activity, including changes in the androgen estrogen ratio There is a possibility of sterols the sex hormones and other hormones normally

(7) Surg Gynec & Obst 76 147 163 February 1943

and transdiaphragmatic subtotal resection of the stomach and esophagus with permanent anterior esophagostomy, (3) construction of a permanent gastric fistula by a Janeway gastrostomy and (4) anterior or prethoracic dermato esophagoplasty to unite the esophagostomy and gastrostomy stomas

The pathologic specimen showed that the bulk of the tumor was a papillary intragastric adenoma malignum of low grade malignancy, which could account for the long history slow rate of growth and failure of the cancer to metastasize widely In two regions, however, the cancer had become solid adenocarcinoma, grade 3 The patient, in a moment of despondency, committed suicide and at autopsy a single tiny preaortic lymph node containing one focus of metastatic carcinoma was found

Juan C Luxardo[2] reports a case of *primary malignant lymphogranulomatosis of the stomach*

Woman 37 in 1932 had pain in the right iliac fossa radiating to the epigastric region and later to the right thigh, with nausea Biliary vomiting and nearly constant pain were present in 1934 when she underwent appendectomy Symptoms soon returned and pain became frankly epigastric In September, 1938, pain was worse and a tumor the size of a nut in the epigastrium gradually increased Pain now radiated into the left hypochondrium and was aggravated after meals When admitted in January, 1939 with intractable vomiting and continuous epigastric pain, she had lost nearly a third of original weight

Palpation of the epigastric region revealed swelling of average hardness elastic, with smooth surface the size of half an orange movable in all directions and painful on moderate compression Wassermann and Kahn tests were frankly positive Gastric juice showed 0 80 total acidity and contained blood Operation disclosed an irregular, grayish swelling with small hard nodules, from the lesser curvature to the anterior aspect of the antrum Numerous hard whitish lymph nodes of varying size were spread along the lesser curvature nearly to the cardia in the gastrohepatic epiploon and over the pancreas Ample gastrectomy (Polya) was performed and the lymph nodes were extirpated Postoperative course was normal Histologic diagnosis was malignant lymphogranulomatosis Sulfarsenol treatment was instituted She was discharged in March 1939

Except for admission in December 1941 to drain a small abscess of the epigastric abdominal wall of 10 cc purulent

( ) Semana méd 50 68 90 Ja 14 1943

tients for the traditional transabdominal wall approach under ether with their tolerance for the transpleural approach under ether, as far as surgical "fatigue" is concerned Those in the transpleural group tolerate operative procedure at least as well and perhaps better than those in the other group Thus when the transpleural route is indicated for anatomic reasons and when the operating team is experienced, it appears that the poor risk patient does not necessarily rule out the high approach Excellent tolerance for the transpleural approach is due to the fact that a far lighter level of anesthesia is possible than in transabdominal wall approach for the only relaxation needed is that of the diaphragm, obtained by block of the phrenic nerve under direct vision Disturbance of the other abdominal viscera, well known to cause harmful circulatory effects, can largely be avoided

George T Pack and William L Watson[1] (New York City) report a case of *transthoracic subtotal gastrectomy and esophagectomy for cancer* which involved so much of the stomach and esophagus as to prohibit anastomosis A prethoracic artificial esophagus was subsequently constructed

Man, 33 had a history of indigestion, dysphagia and other symptoms of gastric cancer These symptoms continued for five years before cancer was discovered by roentgenography and laparotomy At the age of 38 the patient was subjected to an initial exploratory operation at another hospital, size and location of the tumor at the cardia were such as to cause the lesion to be classified as inoperable by abdominal approach Two years later it was still possible to resect this cancer by the transthoracic and transdiaphragmatic approach Because the cancer involved the major part of the stomach (superior two thirds) and a considerable segment of the esophagus, it was not possible to accomplish an intrathoracic anastomosis of the esophagus to the residual stomach or to the jejunum The operative procedures required four stages (1) abdominal exploration to ascertain the extent of the disease and temporary jejunostomy for feeding purposes, (2) transthoracic

(1) Arch Surg 46 930 9 8 June 1943

The blood shows secondary anemia with polynucleosis and leukopenia, polynucleosis and eosinophilia, if well marked, are significant Duration seems to be the same as for other localizations, the course is rapid and progressive However, remissions lasting to seven or eight years are not infrequent

Treatment is usually palliative because the lesions are already advanced when first seen Roentgen therapy may give lasting improvement Early and also acute cases should receive surgical treatment

Localization in the reticulo endothelial system and the concept of local reticulo endothelial systems suggest that the disorder is of inflammatory nature, having various etiologies which cause a particular tissue reaction, and that it may be cured by extirpation in the early stage, i e, that of invasion of the local reticulo endothelial system

Actinomycosis of the stomach and duodenum is rare It seems that only 3 cases of primary actinomycosis of the stomach and 2 of the duodenum and 10 cases of actinomycosis of the subphrenic space have been reported Edwin W Shearburn[2] (Univ of Virginia) describes two cases one of gastric and duodenal actinomycosis with associated pyloric obstruction and duodenal ulcer, which is asymptomatic 18 months after operation and is the only case found in the literature in which the patient lived over one year after operation, and another of subphrenic actinomycotic abscess with persistent infection presumably resulting from perforation of a duodenal ulcer

On the basis of these two cases and the reports in the literature, no definite opinion as to the pathogenicity of fungi in gastric and duodenal ulceration can be formulated After perforation occurs through an ulcer in which fungi are present, the problem becomes one of peritoneal contamination and the presence of fungi may affect the subsequent course of infection

(2) Surgery 14 38 46 July 1943

fluid, she remained well A follow up examination made in April, 1942, showed her to be in normal condition

Gastric localization of malignant lymphogranuloma is rare only 25 cases have been reported, 20 of them be fore the war Of these 20, 16 were diagnosed cancer or tumor and 4 ulcer In seven, results were favorable for 1 to 10 years No further information is available about 8, and 5 patients soon died, 1 without operation and the others of postoperative complications

No matter what its localization, the process always originates in the part in which reticulo endothelial tissue is most abundant In addition to the general reticulo endothelial system, there are local systems which act in a limited zone at the attacked site Existence of these systems would explain presence of localized malignant lymphogranuloma, and this concept would also explain secondary generalization of the disease, as the general reticulo endothelial system would come into play when the local system has been overcome

Macroscopically, the lesions assume various forms which may appear individually but are generally found together in the same case the nature of these lesions explains the diversity of the clinical pictures The forms include simple infiltration, ulceration, tumor and scler otic cicatrization

Symptoms vary greatly and may simulate any gas tric disease Gastric localization may assume two types that of cancer and that of ulcer, and diagnosis is then made only by operation histologic examination or au topsy Omitting cases associated with hepatospleno megaly and adenopathy there are some signs which may help in establishing the diagnosis frequent co existence of abdominal pain, meteorism and sometimes diarrhea irregular fever without evident cause, tumor associated with considerable loss of weight occurring more rapidly than in cancer, roentgen image showing extension of the process toward the esophagus or invad ing the duodenum Gastric acidity is mostly normal

remained asymptomatic for 18 months following operation would seem to indicate that the mycotic infection is probably no longer a source of danger During the early postoperative phase, thymol therapy was considered However, the patient's immediate and continued excellent response to gastro enterostomy soon made it evident that any drug or roentgen therapy was contraindicated

The problem at the stage in which the second patient was observed was one of diffuse infection throughout the upper abdominal wall and subphrenic space The response to adequate surgical drainage supplemented by thymol therapy was good Any share of thymol in the patient's improvement is, of course, not proved and sulfonamide therapy did not result in a high enough blood concentration to be effective Possibly further therapy will be necessary if a permanent cure is to be hoped for The course of peritoneal actinomycosis is so deceptive that future exacerbation of the disease must be expected

Ulcer—To clarify the *treatment of secondary peptic ulcer,* Cranston Holman and Arthur Chenoweth[3] studied 81 cases followed at New York Hospital and summarize the conditions under which secondary ulcer may develop (1) These patients may be considered of a constitutional type which under certain circumstances is predisposed to develop ulcer (so called ulcer diathesis) Physiologic make up directs psychic stimuli to the upper gastro intestinal tract so that ulcer may develop in the presence of other factors (2) Constant finding of considerable acid in gastrojejunal ulcers indicates that relatively high acidity is important in development or persistence of ulcer (3) There are exaggerated psychic stimuli which in presence of the preceding factors play an important role in development These stimuli not only produce a more constant and greater amount of gastric secretion and abnormal motility but also

(3) Surg Gynec & Obst " 314 3? September 194?

Bearse reviewed the literature in 1938, stressing the absence of any characteristic syndrome warranting a preoperative diagnosis, and Singer concurred in this However, they stated that bloody vomitus, such as occurred in the first case of Shearburn, is an almost constant character of a mycotic lesion of the stomach Bearse urged routine preoperative study of gastric washings for the presence of mycelia and suggested the possibility of a presumptive preoperative diagnosis by demonstration of organisms in the gastric contents together with positive serologic evidence However, in neither of the present two cases was it possible to demonstrate fungi in the gastric washings

The clinical features of the first case were essentially those of duodenal ulceration with increasing pyloric obstruction The episode of hematemesis was not interpreted as being of more than the usual significance In the second case, there was no history of bloody vomitus prior to or following perforation The patient had had gnawing epigastric pain relieved by food and soda The subphrenic infection was preceded by fatigue, malaise, anorexia and vague epigastric and right upper quadrant discomfort Later, pain became more severe and was aggravated by respiratory movements There were no associated respiratory symptoms

Treatment of gastroduodenal ulceration caused by or secondarily invaded by actinomycosis should in theory consist of resection of the involved part if this procedure is possible Roentgen therapy large doses of potassium iodide or one of the sulfonamides may be indicated when there is generalized abdominal infection Thymol by mouth and locally has also been used in treating actinomycotic infections elsewhere in the body

In the first case, gastro enterostomy was performed because of the apparent risk from resection of so extensive a lesion involving the pancreas and also because the diagnosis was uncertain Certainly the surgical treatment was in no way specific The fact that the patient

mortality is high, resection should not be regarded as infallible or be undertaken lightly, for these patients in particular conservative therapy should be given fair trial

Recurrence of primary ulcer, after suture of perforation or pyloroplasty or excision, is a relatively simple problem If surgery is to be done, resection is the procedure of choice since less radical methods result in a high percentage of failures Whatever the operation, it should be planned so that it can be terminated any time If a gastric resection is decided on, the gastroenterostomy should first be dismantled and then, if the patient's condition permits, resection can be completed In this way operative mortality is kept at a minimum

Of the 81 patients, 28 were treated conservatively after the original operation and 53 were subjected to secondary operative treatment, undergoing 135 operations (53 primary and 82 secondary) for ulcer or its complications—2 5 operations per patient Every patient originally had gastric or duodenal ulcer except one who had ulcer and leiomyoma of the stomach Each patient has been seen at regular intervals of not more than one year, so the conclusions are derived from several examinations and x ray studies Results are based primarily on subjective findings, so they have been classified as good or poor rather than as recurrent or cured Failure to get relief from pain, bleeding, or roentgen evidence of ulcer sufficed to classify a case as poor Judged by these standards, of the 53 patients given secondary operative treatment, results were good in 28, and poor in 18, 7 died

Howard Ulfelder and Arthur W Allen[4] review 334 cases of *acute perforation of gastric or duodenal ulcer* seen at Massachusetts General Hospital from 1916 to 1940 Diagnosis of all but four was confirmed at operation or autopsy One of the four, moribund on admission had a history and physical symptoms consistent with

(4) New England J Med [illegible] 780 784 Nov 19 194[illegible]

change vascularity of stomach and duodenum, providing an ideal setting for ulcer formation Finally, many factors, such as poor operative technic, nonabsorbable sutures in line of anastomosis, size and location of stoma irregular habits of living, overindulgence in *alcohol and* tobacco, faulty diet, etc, have been considered as causing recurrent ulcer, but probably only in exceptional cases can one of these alone be held primarily responsible

Treatment may be conservative or operative, except for those ulcers complicated by free perforation or gastrocolic fistula which demand operation Present treatment of uncomplicated secondary ulcer is far from satisfactory To be successful medical therapy should include not only initial period of rest in bed, restricted diet and abstinence from tobacco and alcohol but also readjustment of mental attitude and especially, adequate accommodation to environment Among patients treated *conservatively in this series, 9 of 11 who responded* made satisfactory mental adjustments, while 29 of 35 who failed to respond had failed to adjust themselves satisfactorily It seems reasonable to conclude that if a complete regimen of medical therapy is available it should be given a trial but if within a short time *the ulcer* has not healed operation should be advised

Because of inadequacy of less radical procedures, gastric resection has long been used, although not uniformly accepted as the operation of choice in treatment of secondary ulcer results obtained are uniformly better than with any other surgical procedure

The problem of secondary ulcer after resection is much more serious, since surgery is limited to either more extensive resection or excision of ulcer with revision of the stoma Because the latter generally fails to prevent another recurrence, resection is strongly advised if circumstances permit, but the 20 25 per cent mortality in secondary resection should be considered when planning therapy Since ulcers may recur and

Mortality by five year periods showed no significant variation in 15 years (26 7 26 4 per cent) Mortality during winter was appreciably higher than during other seasons, which may be related to virulence of current respiratory tract infection Mortality rises with age The interval between perforation and closure is of basic prognostic importance, as the most rapid rise in mortality occurs 3 6 hours after perforation, in most patients who recovered after intervals of more than 15 hours the perforation had already spontaneously sealed

Gastrojejunocolic Fistulas—John S Atwater, Hugh R Butt and James T Priestley[5] found 42 cases in the records of the Mayo Clinic from January, 1935, to January, 1942 With two exceptions, cases in which the fistulas were complications of malignant disease of the upper portion of the gastro intestinal tract, the fistulas followed gastrojejunal ulcer the ulcer having been a sequel to a previous operation, usually gastro enterostomy In 42 per cent of the 40 cases, the fistula occurred within a year after the original operation In one patient a fistula developed for the second time All patients were males The average age at the clinical onset was 45 years The estimated incidence of gastrojejunocolic fistula in the presence of gastrojejunal ulcer varies between 11 and 14 per cent

Diarrhea and fecal belching or vomiting are the most common symptoms Evidence of malnutrition is manifold Extreme loss of weight and strength and presence of dehydration emaciation hypoproteinemia nutritional edema anemia and multiple vitamin deficiency states are characteristic Vitamin deficiencies such as night blindness peripheral neuritis paresthesias pellagra, glossitis, conjunctivitis, cheilosis ecchymoses with decreased values for ascorbic acid in the blood and hypoprothrombinemia have been observed The primary object of preoperative care should be to replenish each of the depleted body nutritional stores and in so doing

(5) Ann. Surg 117 414 4 6 March 1943

long standing ulcer and acute perforation of 34 hours duration, the other three who survived without operation had histories compatible with recent perforation, physical signs consistent with peritonitis, free air under the diaphragm demonstrable by roentgenogram and ulcer shown by subsequent barium meal

Only 13 patients were women, this sex ratio of 1 25 is interesting, since ratio of ulcer in general is 1 6 The proportion of women with ulcer complicated by perforation accords with their peculiar protection against fatal hemorrhage from ulcer Incidence of the other chief surgical complication of ulcer, i e, cicatricial obstruction, is more nearly equal in men and women Five deaths among these 13 women suggests that acute perforation is more hazardous in women than in men

Considering only the 321 males, risks from perforation of an ulcer proximal to the pylorus appears slightly greater than of one in the duodenum Nine patients in the entire group who had survived a previous perforation recovered from the second episode This was no mere coincidence, more probably the patient, recognizing recurrence of former symptoms, obtained treatment sooner, thus the all important time factor operated to his advantage

Patients who have recovered from acute perforation should be followed carefully and usual ulcer management applied If response to conservative treatment is satisfactory, there is no reason to place them in a separate category If cicatricial stenosis, massive hemorrhage or intractability occurs, surgery is justified

One patient apparently had simultaneous perforation of more than one ulcer This was unrecognized at operation, and the patient died of peritonitis It is assumed that the second ulcer perforated during convalescence following suture of the first There is no way to foresee such a complication, and the incident does not warrant extensive exploration Dangers of too much handling far outweigh risk of overlooking a second perforation

20 years The physical findings are indefinite and inconclusive, and they may be entirely lacking

The diagnosis is attended with considerable difficulty Roentgen examination may fail to differentiate multiple polyposis from chronic hypertrophic gastritis, retained food, bezoar or sarcoma In the cases analyzed the correct diagnosis was made most often by roentgen rays and operation, but the condition was often overlooked by the roentgenologist Gastroscopy is a valuable aid, especially in the differentiation between benign and malignant lesions and between polyposis and hypertrophic gastritis Both methods are complementary and their combined use is recommended

Free hydrochloric acid was absent from the fasting gastric content in almost every case Careful search should be made in the gastric content for tumor particles which may establish the diagnosis

In the previous series of cases malignant alteration was noted in 12 per cent In the present series, four showed no malignant alteration Of the remaining 37 malignant alteration was found in 19 This alone argues for radical surgical removal of the tumor bearing area by gastric resection as soon as diagnosis is made and the patient is properly prepared Further confirmation for this policy is afforded by the separate analyses of a small number of benign and malignant cases in which patients were treated either by excision of polyps or by gastrectomy, these show a great superiority of results in gastrectomized subjects

Jacob S Rubin[7] (Jamaica, N Y) reviewed the literature from 1923 and found that *prolapse of polypoid gastric mucosa into the duodenum, with malignant change* is uncommon In pedunculated tumors with prolapse through the pylorus, the patient may complain of paroxysmal epigastric pain radiating to the back, of oral bleeding or of melena Pain appears to have no relation to meals, vomiting is uncommon Roentgen findings are

(7) Radiology 38 362 364 March 1942

to restore the patient to satisfactory chemical and physical health, so that operation can be performed with the least possible risk

The operation of choice for gastrojejunocolic fistula consists of resection of the stomach after the stomach, jejunum and colon have been detached from their fistulous connection In certain cases preliminary colostomy may be advisable In the present series of 41 cases (40 patients, of whom one underwent operation twice for fistula) the operative mortality was about 27 per cent There are reasons for the belief that this rate will be materially reduced in the future Results after gastric resection are definitely superior to those which follow mere removal of the fistulous tract in a procedure unassociated with partial gastrectomy

Tumors —*Multiple Gastric Polyposis* —Felix L Pearl and Harold Brunn[6] (Mount Zion Hosp , San Francisco) analyze 41 cases including 3 new personal ones This report is supplementary to a previous review of 84 cases published in 1926

The disorder may be congenital (neoplastic) or inflammatory (hyperplastic) The two types may often be differentiated on gross examination alone Microscopic examination of neoplastic polyps shows that the muscularis mucosae and the submucosa enter the tumor for a variable distance and that the former becomes fragmented or split In the hyperplastic type, the muscularis mucosae is intact and forms a delineating membrane, the submucosa playing no part in the formation of the tumor Borderline cases may be difficult to classify

The symptoms are not characteristic In the present series of cases epigastric pain and tenderness were most frequent In over half of the cases, blood was found in the vomitus, stool or gastric content Pedunculated tumors and those near the pylorus are more apt to give rise to symptoms of separation of polyps or pyloric obstruction Some patients have had symptoms for over

(6) Surg Gynec & Obst 76 257 281 March 1943

to ulcerate, with bleeding and anemia Origin is usually low grade inflammation from chronic irritation, with eventual mucosal hypertrophy and attempt to expel the mass by peristalsis, as a foreign body Differentiation from ulcer is possible only by means of roentgen studies

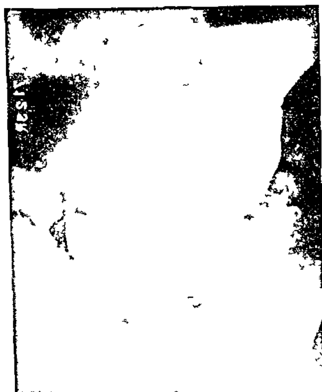


Fig 93 —Prolapse of gastric mucosa filled stomach prone position

Woman, 63, had heart burn nausea epigastric distress and loss of weight for four months previously, and tarry stools for one month Vomiting occasionally gave relief, otherwise pain lasted for hours A lump 2 or 3 cm in diameter was felt in the pyloric region She refused roentgen studies and was placed on a dietetic regime with vitamins and antispasmodics Fifteen months later she had grown steadily worse lost 20 lb and was unable to retain even liquids The mass was unchanged, but pain now radiated to the back and constipation was severe A tentative diagnosis was malignant tumor

characteristic a central filling defect in the duodenal bulb, with some streaking of contrast medium about it The defect may not appear with the patient erect, but is demonstrable in the prone or right oblique position Peristalsis is not disturbed unless the tumor has undergone malignant change with infiltration of the muscular coat of the stomach A varying degree of six hour resi



Fig 9_ —Prolapse of ga tric mucosa six hou roent en gram erect position Note gastroduodenal residue and irregular motility

due is observed depending on degree of ball valve action No gastric defect is visible with prolapse of a pedunculated tumor through the pyloric ring With prolapse of gastric mucosa the appearance may resemble the deformity observed when there is slight pressure of the pyloric region on the spine Secondary anemia is present

Papillomas, adenomas, fibromas and polyps, multiple or single, usually found near the pyloric ring, are prone

Review of the literature reveals many attempts to designate gastritis as precursor of gastric carcinoma In 1939, Robertson defined residual lesions of ulcerative gastritis as "irregular thickening and fibrosis of the muscularis mucosae, atrophy of the chief and parietal cells, hyperplasia of the mucous cells and disorganization of the mucosal elements" One of his conclusions was that hyperplasia of mucous glands may be related to development of carcinoma

To investigate residual lesions in gastric mucosa long before gastritis (as described by some authorities) could be diagnosed, Judd studied specimens of 200 carcinomas of the stomach removed at operation, autopsy, or both from subjects whose average age was 58 7 Sections for microscopic examination were taken directly through the carcinoma and at a standard distance of 10 cm from the edge As control, he examined 78 average stomachs obtained at routine autopsy examinations of patients who had been known not to have carcinoma of the stomach and whose average age at death was 55 3

Finding of essentially similar lesions at a distance from a carcinoma suggested that the entire mucosa had undergone change and that much time had been required for this change to occur The fundamental difference between the average carcinomatous and noncarcinomatous stomach is relative lack of mucous cell hyperplasia in the latter Judd concludes that carcinoma develops in a previously damaged stomach Many years of such injury may be required before neoplastic transformation begins Pathogenesis of gastric carcinoma is directly related to disorganized hyperplasia of gastric mucous cells

To determine the etiologic relationship between *chronic atrophic gastritis and cancer of the stomach* Lewis W Guiss and Fred W Stewart[3] (New York City) studied five distinct groups of material including stomachs of infants (premature, still born at term and

(3) Arch. Surg 46 823 843 June 1943

Roentgen examination revealed a small six hour gastro duodenal residue The stomach showed moderate hypersecretion, slight pyloric narrowing and rapid emptying with active peristalsis The large, tender bulb at all times had a cottony appearance and sluggish motility At 24 hours there was some delay in colonic motility, tenderness and limited mobility of the ileocecal area were observed At 48 hours, the meal had reached only the sigmoid colon Tenderness was still present in the ileocecal region

Diagnosis was polypoid herniation of gastric antral mucosa into duodenal bulb and chronic low grade ileocecal inflammation Blood count was red cells 3,250,000, white cells 7,200, with normal differential count

At operation, the liver showed signs of hepatitis, gall bladder and cystic duct contained several calculi, and some adhesions were present The right ovary was enlarged and contained a hard mass Stomach was normal on the surface but a mass in the pyloric region could be pushed freely into the duodenum The lower 7 cm of the stomach and 1 cm of the duodenum were removed and a gastrojejunostomy performed Interference in the right ovary or gallbladder was deemed inadvisable

The section of stomach showed a large polypoid mass on the inner surface about the size and shape of a plum and numerous small polyps of varying size, with no gross evidence of extension into stomach musculature Histologic diagnosis was gastric polyposis with carcinomatous degeneration The patient was alive and well nearly three months after operation

Edward S Judd, Jr[8] (Mayo Clinic) discusses the *possible relationship of residual lesions of ulcerative gastritis to development of carcinoma of the stomach* The concept that cancer arises from abnormal proliferation of a single cell which assumes aspects of malignancy from the start and rapidly develops into a dangerous tumor may be correct However, in some tumors at least, years and even decades of preparation may have preceded appearance of actual malignancy Although advancing years and hereditary tendencies undoubtedly are factors in releasing the inhibition to unrestrained growth, they probably are not the entire causative background Significance of changes in gastric mucosa over many years may not have been stressed sufficiently

(8) Surg Gynec & Obst 75 4 432 October 1942

normal persons who died within the gastric cancer age (over 40), 66 per cent of stomachs from persons over 40 who died of extragastric cancer and 97 per cent of stomachs with gastric carcinoma show associated chronic atrophic gastritis There is a similar incidence of chronic atrophic gastritis in association with gastric diseases other than carcinoma The chronic atrophic gastritis associated with gastric carcinoma is a nonspecific "re action" to inflammation and gastric injury in general, and there is no evidence to suggest an etiologic relation ship other than that chronic atrophic gastritis may be caused or intensified by the presence of carcinoma in the stomach The factors included in the present concept of chronic atrophic gastritis i e, mucosal atrophy, in creased amounts of leukocytic infiltrate and lymphoid aggregates, intestinal metaplasia and pyloric gland heterotopia are all rather closely correlated, variation in one factor tending to be associated with proportionate changes in the others This correlation probably justifies the consideration of these changes as a pathologic entity

The often reiterated claim that chronic atrophic gas tritis is a precancerous lesion receives no positive support as a result of this study The slight difference in inci dence of gastric atrophy between cancerous and non cancerous stomachs is not convincing Atrophic gastritis is an exceedingly common condition with advancing age Mere statistical correlation of incidence of gastric atrophy and of gastric cancer is insufficient to show causal relation Both atrophy and cancer appear to be events in aging organs Were the effort made, it would doubtless be easy to show that gastric cancer was corre lated not only with gastric atrophy but likewise with atrophy of other organs even in fact with atrophy of such anatomically unrelated structures as the genitalia, breasts, circulatory apparatus or even skin thus reducing to absurdity the conclusions based on mere statistics as to incidence

To assert on morphologic grounds that the origin of

dying within a few days of birth), normal stomachs of persons without history of gastric disease, normal stomachs of patients who died of nongastric cancer, gastric carcinomas and unselected specimens resected for gastric lesions other than carcinoma

Intestinal metaplasia, pyloric gland heterotopia, mucosal cysts instances of dedifferentiation of specialized cells and lymphoid collections are not present at birth and must therefore develop postnatally, probably as a result of mucosal damage Mucosal development is not complete until the beginning of the second decade, when it reaches a plateau maintained until the sixth decade, when a slight decline begins The glands of Brunner attain their adult appearance about the end of the first year The cardiac glands of the stomach are of esophageal rather than gastric origin They become fully developed during the first decade The authors are unable to substantiate the theory of "digestive leukocytosis" with their material Parietal cells may normally be found extending into the duodenal mucosa There is a steady increase in the number of lymph follicles and lymphoid collections in the gastric mucosa until the fourth decade, after which the increase tapers off There is a slight but steady increase in the amount of leukocytic infiltrate present with the passage of each decade without reference to any special type of cell Intestinal metaplasia, heterotopia of the pyloric glands, mucosal cysts heavy leukocytic infiltration and large numbers of lymphoid aggregates are never found in truly normal stomachs, but are evidences of gastritic changes Stomachs of patients who died of cancer other than gastric cancer are essentially identical with those who died from other causes, except that they contain fewer lymphoid follicles and collections and less leukocytic infiltrate This difference is directly proportional to the degree of malnutrition present and not due to the presence of cancer itself

Eighty two per cent of stomachs from apparently

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To assert on morphologic grounds that the origin of

gastric cancer depends on the existence of gastric atrophy would require far more evidence It would at least require proof that early gastric cancer begins in and can be directly traced to, an area of atrophy to the exclusion of other areas From the very nature of gastric material universally available in large clinics, this type of evidence, although it may eventually appear, will be long in coming Could even this be proved correct, the larger question would still remain unanswered as to why A, with gastric atrophy gets cancer and B, with the same atrophy, does not Prematurity in formulating important conclusions in matters of this sort is unjustified

[This is a timely study There are far too much loose thinking and too many *post hoc propter hoc* conclusions —Ed]

Leon Schiff[4] (Univ of Cincinnati) made the *gastroscopic diagnosis of gastric cancer* in 53 (and subsequently 55) of 78 proved cases of the disease In seven cases gastroscopic examination was the sole means of revealing the presence of the tumor In 10, the examination was unsatisfactory because of failure to introduce the instrument or poor visibility, in 6 additional cases, the lesion was situated in a blind area and was not seen while in 9 instances it was mistaken for another type of lesion, most commonly a benign gastric ulcer In 13 cases selected from a miscellaneous group, lesions proved histologically to be other than primary gastric carcinoma were mistaken for gastric cancer

While the gastroscope may be more helpful than the roentgenogram in the diagnosis of gastric cancer in some cases the converse is more frequently true In 11 patients the roentgenogram was the sole means of revealing the presence of the tumor By the use of both methods the percentage of correct diagnoses will be higher than by the use of either alone

In looking through a gastroscope the clinician should constantly bear in mind that he is viewing only part of the mucosal surface of the stomach, not its entire sur

(4) Arch Surg 46 865 870 June 1943

face nor its deeper layers or surrounding structures It is only by weighing the information he thus obtains with the evidence he collects from the history and physical, roentgen and other examinations that he will most frequently arrive at a correct diagnosis

In their *metabolic studies of patients with cancer of the gastro intestinal tract,* P E Rekers, George T Pack and C P Rhoads[5] (New York City) investigated eight controls whose disorders were unrelated to the gastro intestinal tract three patients who had undergone total gastrectomy for carcinoma of the stomach and survived operation for over six months one patient who had undergone partial gastrectomy for carcinoma of the pre pyloric region and still secreted considerable quantities of free and combined hydrochloric acid and one patient bearing a carcinoma of the prepyloric region which was deemed inoperable because it was adherent to the pancreas and large vessels posteriorly

The patients with total gastrectomy had an impaired ability either to digest or to absorb the fat of the diet and, in one, the protein of the diet Deficiency of bile salts or of a pancreatic hormone, lipocaic, could not be considered causative factors for the disturbed lipid metabolism Pancreatic enzyme appeared to be effective in reducing the steatorrhea in the one patient studied Beef supplements to the diet were effective in reducing the steatorrhea in two of the three patients studied A refractory rather than a macrocytic anemia was demon strated

The effects of total gastrectomy on nutrition and hematopoiesis were studied by J Matthews Farris, Henry K. Ransom and Frederick A Coller[6] (Univ of Michigan) The mortality rate following this operation is not prohibitive There were two deaths in the last 19 consecutive cases, one was in a man of 79 In a series of 29 cases, there are four survivals of over two years One

(5) Surgery 14 197 215 August 1943
(6) Ibid. 13 823 833 June 1943

patient is well four and a half years after operation

The stomach does not play an essential role in the digestion of fats and protein. There is no experimental evidence that removal of the stomach will produce pernicious anemia. Clinical experience likewise indicates that primary anemia is rarely encountered following various gastric operations. But gastrectomy interferes with the metabolism of iron. Absorption of glucose is more rapid than normal. This results in a transient hyperglycemia phase followed by hypoglycemia. This latter may produce characteristic symptoms. A high protein, low carbohydrate diet is efficacious in preventing these abnormalities. Motility is decreased rather than increased. This may be due to intra-abdominal section of the vagus nerves.

Total Gastrectomy for Carcinoma.—James H. Saint (Santa Barbara, Calif.) describes a case of scirrhous carcinoma of the stomach.

In a man, 64, the whole organ was involved, and total gastrectomy, antecolic esophagojejunostomy and jejunojejunostomy were successfully performed. He survived 14 months. At time of operation a liberal estimate of life expectation was three or four months, during which could be anticipated increasingly severe symptoms leading to a miserable existence. Instead, total gastrectomy gave him almost a year of good health, during which he was able to follow his vocation with former vigor for several months. Only for the last two months of life, when recurrent ascites developed, were normal activities curtailed, and even then he did not suffer unduly.

In Saint's experience death due to metastatic deposits from excised carcinoma of the stomach is usually so much more merciful than that which occurs with the primary growth still in place, whether or not a palliative operation is done, that it is worth taking a definite risk in an attempt to remove the primary growth even if total excision of the stomach is required. Should death occur soon after total gastrectomy, it would be natural to wonder whether the attempt had been worth while, but

(7) West J Surg 51 10 16 January 1943

a large number of patients could not have enjoyed the respite afforded them for months or years except as a result of this extensive operation

Otto Saphir and Morris L Parker[9] (Michael Reese Hosp, Chicago) report 26 cases of *linitis plastica type of carcinoma* of the stomach, 3 of the large intestine and 1 of the gallbladder The interval between onset of symptoms referable to gastric disorders and death was uncommonly short compared with that of a control group of patients with miscellaneous gastric carcinomas The postoperative survival periods of 15 patients who were operated on seemed extremely short, being 11 days or less in 11 patients Among nine patients with gastric carcinoma and no metastases who were subjected to operation, all with the linitis plastica type of carcinoma (four) were found to be inoperable as compared with only one patient of the miscellaneous group (five)

Grossly, and particularly histologically, the linitis plastica type of carcinoma must be differentiated from other types It is characterized histologically by subacute and chronic inflammation with much fibrosis and hyalinization, by small darkly stained cells with little cytoplasm and small cells of low cuboidal shape with transitions to typical signet ring shaped cells and by miniature glandular structures Metastasis in the liver was found only 3 times in this group of cases, but 19 times among the 40 miscellaneous types of carcinoma of the stomach Three of six females showed metastasis to the ovaries compared with one of the six females in the miscellaneous group

It is questionable whether linitis plastica, in the sense of a purely inflammatory lesion, exists Among 6 520 autopsies there was not a single instance The only chronic inflammatory lesion in the stomach in this group, was diagnosed as the result of syphilis The chronic inflammatory changes in the stomach in cases

(9) Surg Gynec & Obst 76 706 713 February 1943

of the linitis plastica type of carcinoma with severe fibrosis may be explained on the basis of early, so called serous inflammation and resulting overgrowth of connective tissue as it is known to occur in other organs

George F Schroeder and Herbert J Schattenberg[8] (Tulane Univ) describe nine cases of *sarcoma of the stomach*

In recent years there has been a considerable increase in the number of cases reported, owing to better clinical and pathologic standards of diagnosis, and it is generally agreed that sarcoma constitutes about 1 per cent of all malignant gastric tumors It may appear at any age but is usually a disease of middle age, attacking persons a decade younger than the average patient with carcinoma Most reports emphasize a predominance in males, in the present cases four were males and five females The cause of the tumor is unknown

The clinical picture varies considerably with location of the lesion its size and presence or absence of ulceration and infection Pain which is often of the ulcer type is the most common complaint Epigastric pressure may be an early symptom frequently the first indication of the disease is an epigastric mass A palpable tumor is present in 30 to 40 per cent of cases Nausea vomiting anorexia, loss of weight and weakness develop rapidly The lesions seldom bleed but tarry stools are occasionally noted Massive hemorrhage and perforation are rare The presence of generalized lymphadenopathy indicates systemic involvement Often low grade fever accompanies the condition but it is seldom of the Pel Ebstein type until late in the course Diagnosis can be made only by microscopic examination

The pathologic classification of sarcoma in general is still somewhat confusing Ewing mentioned three types when discussing gastric sarcoma and Pack and McNeer recently clarified the problem further listing three main

(8) Arch Surg 47 8 19 July 1943

types (1) spindle cell sarcoma (neurosarcoma, myosarcoma), (2) lymphosarcoma (primary, generalized), (3) miscellaneous round cell or alveolar sarcoma, metastatic sarcoma, such as melanoma

The tumor may be exogastric, intramural or endogastric It may be a diffuse infiltrating lesion or a nodular tumor, or there may be multiple nodules invading the entire gastric wall Other forms are an infiltrating but limited lesion and a pedunculated, bulky, vascular tumor clearly demarcated from the gastric wall

In reality, a sarcoma is a malignant tumor of connective tissue Strictly speaking, malignant tumors of muscle, lymphoid tissue and pigment cells have no place in the classification It has been the general custom however, to include such tumors as lymphosarcoma in this classification and until there is a better understanding of the basic tissues it seems best to apply clinical findings and past pathologic experiences in making up the grouping of sarcomas

Prognosis depends entirely on the type of tumor and its location, extent and duration The differentiated tumors, such as fibrosarcoma leiomyosarcoma and neurogenic sarcoma present a better prognosis than the more malignant undifferentiated myoma A guarded prognosis is always best It can safely be said however that in general, prognosis of sarcoma at present is better than that of carcinoma

Treatment is of three types surgical removal irradiation (radium therapy high voltage roentgen therapy or both) and a combination of operation and irradiation If after exploration and diagnostic examination of a frozen section it is apparent that the lesion is not resectable, irradiation alone should be used If the lesion recedes after irradiation it may be advisable in certain selected cases to resect it at a later date

[The usual conception of a sarcoma is not that it is a malignant tumor only of connective tissue but rather one of any nonepithelial derivative of mesoderm —Ed]

Technic—Dallas B Phemister[9] (Univ of Chicago) recommends *transthoracic resection for cancer of the cardiac end of the stomach* Since most of these patients are first seen in a reduced state of nutrition, appropriate preoperative management is necessary

TECHNIC—Ethylene anesthesia is used with maintenance of a positive pressure of 4 to 6 mm Hg with the face mask A small amount of ether may be added to permit reduction of the concentration of ethylene and increase in the oxygen concentration to around 20 per cent Intravenous administration of physiologic salt solution is started at the beginning and 600 1 200 cc blood is usually given during operation

The patient lies on the right side The left arm is held vertically with the forearm flexed at a right angle and attached to an overhead rectangular frame across the table which also supports the drapes The left side of the chest, flank and abdomen to well past the midline is painted with iodine and the field draped An oblique incision is made over the eighth rib from the costochondral junction to the angle posteriorly, and the skin surfaces are walled off with towels The overlying fibers of the latissimus dorsi serratus anterior and trapezius muscles are incised and the eighth rib is exposed The longitudinally coursing iliocostal muscles are freed and retracted mesially, exposing the angle of the rib The periosteum is incised and stripped and the rib resected from its junction with the cartilage to beyond the angle The pleura is opened the margins of the incision are covered with laparotomy pads and an automatic rib retractor is introduced Adhesions between parietal and visceral pleural surfaces may first require division The ligament attaching the lower lobe of the lung to the mediastinum is divided The esophagus, mediastinum and lung are examined for the presence of tumor If no evidence of intrathoracic involvement except of the terminal portion of the esophagus, is found the lung is held upward by a malleable retractor, the blade of which is shaped roughly to fit a cross section of the chest at this level The retractor is covered with stockinet or with a stocking, the foot being fitted over the blade it usually maintains lung retraction so well that further adjustment during operation is unnecessary The phrenic nerve is pinched with a hemostat until the left half of the diaphragm is paralyzed The diaphragm is opened widely by an incision beginning near its attachment to the chest wall anterolaterally and directed toward the hiatus of the

(9) Arch Surg 46 915 9 9 June 1943

esophagus As the hiatus is approached, branches of the left phrenic artery are clamped and tied The stomach and terminal portion of the esophagus are explored, and the extent of involvement by tumor is determined The lymph nodes of the lesser curvature are examined for metastases The lesser peritoneal cavity is opened by division of the attachment of the fundus to the diaphragm and its peritoneal lining and the retroperitoneal tissues are explored for the presence of adhesions and metastases The hand is introduced into the abdomen and a general exploration for spread of cancer is easily carried out

If the lesion is found operable, the diaphragm is opened to the esophagus The mediastinal pleura is incised and reflected from the esophagus for 3 or 4 in upward, the esophagus is separated all around and a piece of umbilical tape passed about it The separation from the diaphragm is then completed The fundus and greater curvature are ligated off In most cases it is preferable to remove the spleen, as the stomach then becomes more accessible

Division of the gastrohepatic omentum with removal of the lymph nodes of the lesser curvature and isolation and division of the left gastric artery are usually rendered easier if the greater curvature has first been freed Freeing of the curvatures is carried well below the level of involvement when the cancer is primary in the cardiac end of the stomach, when the cardiac end of the esophagus is primarily involved, the left gastric artery is always divided and ligated regardless of whether or not the stomach has been invaded, since satisfactory resection and esophagogastrostomy are not otherwise possible The esophagus and stomach are then pulled forward in the chest An intestinal clamp is applied distally and a Payer crushing clamp proximally and, after walling off, the stomach is divided just beyond it A sucker is in readiness if fluid content is encountered A gauze covering is tied over the proximal end with a heavy silk ligature The distal end is closed with linen silk or cotton sutures The umbilical tape about the esophagus is shifted to a point about 1½ in above the level of division and tied twice, the second tie being a slip knot An intestinal clamp may be used instead The stump of stomach is brought up into the chest to determine whether or not anastomosis may be made without undue tension This is usually possible if one fourth or more of the stomach is left Difficulty in approximation may be overcome by mobilization of the duodenum following the Kocher technic of incising the peritoneum along its right margin A clamp is applied across the stomach to prevent leakage, and the field is walled off

The anastomosis is made between an opening in the anterior wall of the stomach ¾ 1 in away from the closed proximal end An inner row of interrupted through and through and an outer row of interrupted Lembert sutures of fine linen are used Mattress sutures have recently been used in three cases The esophagus may be divided first, or the posterior row of Lembert sutures may be placed before division The knots of the inner row are placed within the lumen The sucker is usually introduced into the stomach immediately on incising the wall In case of inability to approximate satisfactorily the remaining portions of the stomach and esophagus, anastomosis between a loop of jejunum and the esophagus should be made If there is any degree of tension on the anastomosis, it may be relieved by stitching the stomach to the posterior mediastinal tissue or pleura above The mediastinal pleura is then sutured over the esophagus and, in most cases, can be made to cover the anastomosis If this cannot be done, the anastomosis may be surrounded by a fold of omentum sutured about it on both sides A mushroom catheter is inserted posterolaterally through the ninth interspace for pleural drainage, and the chest opening is sutured tightly The remaining air is sucked out of the chest and the catheter clamped until it has been attached with the tube for underwater suction drainage in the patient's room

Postoperatively, the patient is placed in an oxygen tent for two to several days, depending on the course There has been no instance of postoperative shock, owing to the fact that any loss of blood during the operation was compensated for by simultaneous blood transfusion

In 10 patients treated by transthoracic resection and esophagogastrostomy there were four postoperative deaths Of the six who survived operation, three are well, respectively 5 years 20 months and 3 months after operation, one was found dead in the bathroom three months after operation and the cause of death was not learned, one died of recurrence 18 months after operation, and the remaining patient was operated on only one month ago

Five patients were subjected to transthoracic exploration and proved to have inoperable cancer four recovered from operation and one died on the sixth day from pulmonary embolism

M L Steinberg[1] (Portland, Ore) describes a *new method of valvular gastrostomy* which he has used in a man, 74, with carcinoma of the esophagus In the four months after gastrostomy, there had been no leakage of the stomach contents The patient used a large caliber

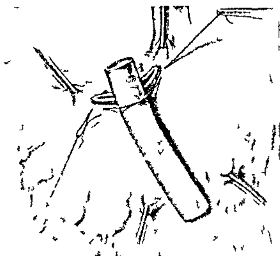


Fig 94 —Incision parallel to lesser curvature suturing of the seromuscularis over rubber tube

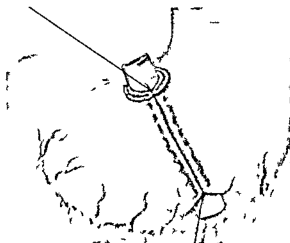


Fig 9 —Tunnel has been formed by approximation of anterior stomach wall over rubber tube

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tube at feeding times only Steinberg can introduce his finger into the stomach through the gastrostomy opening without leakage occurring after the maneuver

TECHNIC (Figs 94–101) —The abdomen is entered through a high left rectus incision An incision about 5 cm long and



Fig 96 —Crushing clamp in place on anterior stomach wall continuous suture of catgut is begun for closure of serosal surface of stomach wall. By manipulation of crushing forceps mucosal surface can be everted and exposed for application of an additional suture over clamp Insert two crushing clamps applied after original suture which fashioned the pedicle tube

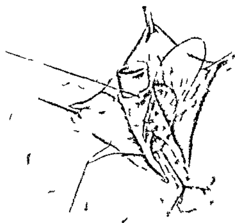


Fig 97 —Mucosal edge of pedicle tube sutured over original seromuscular suture Anterior stomach wall is flared open to demonstrate steps of technic Crushing clamps may be dispensed with if every bleeding point is ligated

more or less parallel to the lesser curvature is made in the anterior stomach wall A rubber tube, 1 5 cm in diameter is placed transversally on the anterior wall and the seromuscularis sutured over the tube The next step may be carried out either by cutting between two crushing clamps and separating the tube from the main stomach or simply by cutting the

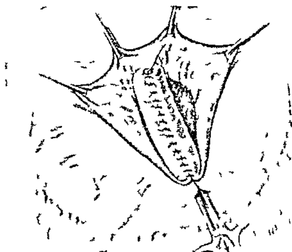


Fig 98 —Pedicle tube at this stage it is lined inside by serosa and outside by mucosa Artery forceps introduced through the tunnel pulls on suture hanging from the terminal end

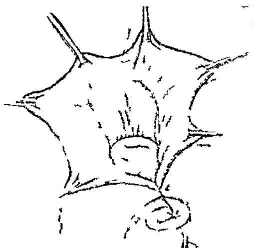


Fig 99 —Pedicle tube invaginated peritoneal surface of stomach wall sutured to peritoneal surface of pedicle tube just below its mucosal cuff

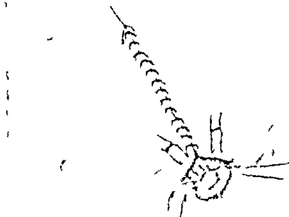


Fig 100.—Surgical wound in anterior stomach wall closed seromuscularis of stomach wall sutured to pedicle tube at serosal margin of the cuff

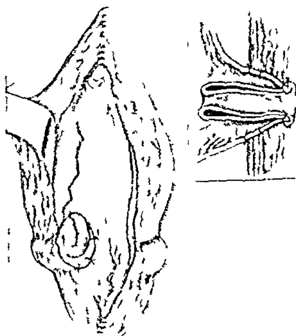


Fig 101.—Stomach wall proper sutured to peritoneum Insert cross-section of valvular gastrostomy Only stomach wall proper is sutured to skin muscle and peritoneum. Leakage from suture line is unlikely to give much concern since pedicle tube is inside stomach

stomach wall on each side of the tube and ligating each individual blood vessel The muco al edges over the pedicle tube are sutured with catgut A long artery forceps is introduced into the lumen of the tube from its greater curvature side At this stage the pedicle tube is lined inside by serosa and covered outside by mucosa The terminal end of the tube is easily invaginated by gradual pull on the attached suture The defect in the anterior wall is closed Serosa of the wall proper is sutured to the serosa of the tube just proximal to the mucosal cuff The valvular gastrostomy, which is double walled, is thus completely and loosely surrounded by anterior stomach wall

If leakage should take place in the suture line, it would escape into the stomach and not into the peritoneal cavity This is also true of the terminal part of the gastrostomy, since the stomach wall surrounding the tube is sutured to the peritoneum, muscle and skin Even if partial necrosis of the terminal end should take place, it would not result in peritonitis On two occasions when the author fastened the terminal end only of the tube to the abdominal wall in dogs, leakage and peritonitis resulted When performing this type of gastrostomy in individuals with a thick layer of subcutaneous fat, it is advisable to make two elliptical excisions of the skin on each side of the protruding cuff

Method of Closing the Pyloro Antral Pouch in the Antral Exclusion Operation—The antral exclusion operation with sacrifice of all the antral mucosa when accompanied by an extensive gastric resection, is a satisfactory and effective operation for so called irremovable or inoperable duodenal ulcer It has not come into general favor among gastric surgeons because of the likelihood of leal age from the residual antral pocket Therefore, Owen H Wangensteen[2] (Univ of Minnesota) describes a technic by which leakage can be avoided

Technic—The operation is performed as shown in Figure 102 The mainstay of the procedure lies in a careful approximation of the submucosa and circular muscle layers by a single row of interrupted sutures of fine silk, placed after the Halsted mattress pattern immediately above the closure of the pyloric mucous membrane In the lower portion of the

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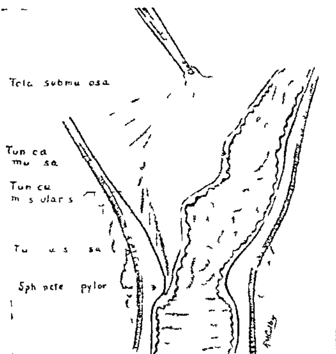
antral pocket near the pylorus, the circular fibers of the muscle coat of the antrum stand out prominently (Fig 103) and appear, when viewed from the inside of the residual antral pouch not unlike a sphincter muscle which in fact this circular muscle becomes at the pylorus After placement of a row of interrupted silk sutures, the remnants of the pouch are cut away leaving only enough tissue to permit easy approximation of the edges without inversion If the circular



Fig 10 —Technic of closure of pyloral antral pouch. *A* division of antrum 4–5 cm above pylorus (usually slightly less than three fingerbreadths) rubber-shod clamp just below pylorus provides secure hemostasis during dissection devascularization carried up to area of induration *B* excision of mucosa *C* closure of divided pyloric mucosa with running fine catgut. *D* approximation of circular muscle by two 3—stitches (Halsted mattress of fine silk with three bites coming and two returning) the stitches lend effect of half purse string *E* circular muscle to be approximated by Halsted mattress sutures of fine silk *F* suture completed two rows of Halsted sutures may be placed dotted line shows site for excision of superfluous seromuscular pouch rubber-shod clamp is now removed *G* trimmed edges of pouch have been approximated without inversion closure is capped with omentum or a margin of right border of transverse mesocolon.

muscle of the pouch is particularly well developed a second row of interrupted silk sutures may be placed if it is felt desirable The final approximation of the edges of the peritoneal muscular cuff may be made with running catgut or

a few silk sutures As a final gesture, the closed pouch is covered with a wisp of omentum or it may be buried gently in the extreme right portion of the right transverse mesocolon Drainage is not used Ordinarily, patients are discharged from the hospital on the eleventh day after gastric resection



F~ 103—Draw_ from aut p y specimen Ten per cent formalin solution put into stomach at autopsy duodenum and esophagus l gated This dissection made after 45 hours of efri~eation Circular muscle is well de eloped seve al c ntimeters prox mal to pyloric sphincter It is approximation of these circular mu cle fibers that is mportant in effecting an adequate and safe cl sure f p loro antral pouch Microscopic studies of antral mucosa removed at ope ati n ind cate that submucosa is removed with mucosa

Dependable aseptic anastomosis offers the best hope of reducing the mortality and morbidity of *gastric and intestinal resections* W Wayne Babcock[3] (Temple Univ) describes a one stage single clamp aseptic method adaptable to any simple or complicated resection and anastomosis of the gastro intestinal tract including subtotal pancreatectomy His object is not to introduce a new

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clamp for gastro intestinal anastomosis, but to demonstrate what apparently has been largely overlooked—that nearly any type of anastomosis for which clamps are used can be done better, aseptically and with but a single clamp A single clamp with blades broad enough to hold well as a rule will have less metal to sew over than two narrow less secure clamps or a three bladed clamp Less bowel or stomach therefore, may be turned in to form an objectionable partial diaphragm and constrict the lumen when a single clamp is used A single clamp is simpler to apply and to disengage, and with less manipulation there may be less contamination With a single bladed clamp, partial or complete gastrectomy partial esophagectomy or gastro esophagectomy, anterior or posterior gastro enterostomy, end to end, side to side, end to side or partial oblique enterectomy and partial resection of the head of the pancreas may be done For most purposes, the small Payr clamps are superior, but an Ochsner or Kocher hemostat a Martzloff Burget Wangensteen clamp, the Stone clamp, the deMartel Cope clamp or other similar instrument may be used For convenient work in the depths of the abdomen clamps without handles are desirable (Fig 107) With a number of such clamps of different lengths, complicated and multiple resections of the stomach and intestine may be carried out without soiling Clamps render apparatus for mechanical semi aseptic suturing quite unnecessary Resection and end to end anastomosis of the small intestine will illustrate the method

Technic —The loop of intestine to be removed with the attached mesentery is liberated, and the arms of the loop at the lines of proposed resection are superimposed by four guy sutures (Fig 104a) or Allis or other visceral forceps to maintain proper alinement While traction is used to spread the apposed loops, two crushing clamps are applied about 5 mm apart Each clamp includes both arms of the intestinal loop in its grasp The loop of liberated bowel is cut off by cautery between the two clamps (Fig 104b) The ends of bowel to be anastomosed now remain alined in the grasp of a single clamp This clamp is turned over, and two or rows of

interrupted or continuous sutures are introduced (Fig 104c) The clamp then is rotated back to its first position, thus exposing the anterior surface of the bowel, and a continuous Cushing suture is applied over the clamp (Fig 104d) While traction is made on the ends of this anterior continuous suture the clamp is withdrawn, thus inverting the mucous edges into the lumen of the bowel and completing the closure without leakage (Fig 104e) The ends of the anterior suture are tied to contiguous ends of the inner posterior suture One or two

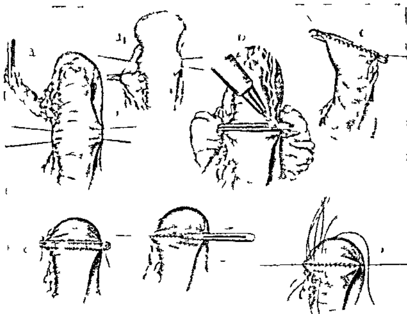


Fig 104 —Aseptic intestinal anastomosis with single clamp *a* and a_1, Arms of long or short loops of bowel to be resected superimposed and alined by traction sutures Broken line indicates line of section *b* Arms of loop doubly clamped being divided by cautery *c* Residual clamp turned over with insertion of first posterior row of sutures a second row to follow *d* Clamp turned back thus exposing anterior face of bowel Anterior continuous Cushing suture introduced over clamp *e* Clamp opened and withdrawn as anterior continuous suture is tightened *f* Second row of anterior sutures being introduced

additional anterior rows of continuous or interrupted anterior sutures are inserted as required (Fig 104*f*) The lumen is established by invaginating the adjacent intestinal wall with the thumb and finger

The removal of a small segment of bowel which has been traumatized or invaded by inflammatory or malignant process may be carried out expeditiously by an oblique single clamp method The affected loop is folded together and the clamp

clamp for gastro intestinal anastomosis, but to demonstrate what apparently has been largely overlooked—that nearly any type of anastomosis for which clamps are used can be done better, aseptically and with but a single clamp A single clamp with blades broad enough to hold well as a rule will have less metal to sew over than two narrow less secure clamps or a three bladed clamp Less bowel or stomach, therefore may be turned in to form an objectionable partial diaphragm and constrict the lumen when a single clamp is used A single clamp is simpler to apply and to disengage, and with less manipulation there may be less contamination With a single bladed clamp, partial or complete gastrectomy, partial esophagectomy or gastro esophagectomy, anterior or posterior gastro enterostomy, end to end, side to side, end to side or partial oblique enterectomy and partial resection of the head of the pancreas may be done For most purposes, the small Payr clamps are superior, but an Ochsner or Kocher hemostat, a Martzloff Burget Wangensteen clamp, the Stone clamp the deMartel Cope clamp or other similar instrument may be used For convenient work in the depths of the abdomen, clamps without handles are desirable (Fig 107) With a number of such clamps of different lengths, complicated and multiple resections of the stomach and intestine may be carried out without soiling Clamps render apparatus for mechanical semi aseptic suturing quite unnecessary Resection and end to end anastomosis of the small intestine will illustrate the method

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hemorrhages occurred After 20 resections of the stomach by this method, including 1 for massive hemorrhage, there was little or no bleeding, then 2 patients had a heavy hemorrhage through the Wangensteen gastric tube

In all cases, a slender, double lumen drainage tube of glass or alloy steel connected to a motor driven suction pump is left in the peritoneal cavity until blood, serum,

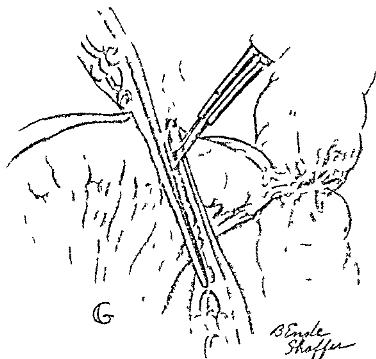


Fig 105 —Double intestinal resection illustrated by removal of short loop of attached ileum with section of colon

bile or other liquids are no longer withdrawn, usually 12 24 hours

In one stage resections of the colon especially of the descending colon and sigmoid, the most dangerous of intestinal resections it is wise to do a complemental appendicostomy or enterostomy at the time of operation

is applied obliquely across the base of the segment of intestine and mesentery to be removed (Fig. 105) A second clamp is applied a few millimeters distal to the first, and the segment is cut off between the clamps with a cautery The segment to be removed then may remain clamped and attached to the primary malignant or inflammatory area, in connection with which it can be removed later Traction and approximating sutures or forceps often are unnecessary for this simple operation After removal of the segment of bowel and omentum the anastomosis is completed by the introduction of rows of posterior and anterior sutures similar to those described for an end to end anastomosis (Fig 106) The anterior inverting suture is carried in advancing loops along the edges of the omentum thus simultaneously closing the gap and arresting hemorrhage

This type of resection is a quick and convenient way to deal with gunshot wounds and other injuries of the intestine fistulous areas and localized tuberculous and malignant implantations The smallest Payr clamp is preferred and is used to crush simultaneously both the bowel and the folded edge of the mesentery

Spinal anesthesia, usually with 1 to 1 4 cc of 1 per cent pontocaine mixed with an equal quantity of 10 per cent procaine has been used For the substandard patient this has been followed by a slow intravenous drip of 5 per cent glucose solution with or without minimal amounts of 2 5 per cent pentothal sodium solution and at times typed and citrated blood Local and splanchnic block with 1 per cent epinephrinized procaine has been used freely

Fine catgut, silk and plain and stranded alloy steel wire have been used for the inner row of gastric and intestinal sutures and interrupted no 36 plain or stranded alloy steel wire for the peritonealizing outer row of sutures, as this material does not cause peritoneal reactions or adhesions There has been no leakage along suture lines following the single clamp method All abdominal wounds were closed with interrupted usually layer, sutures of alloy steel wire

In none of the intestinal resections have intraluminal

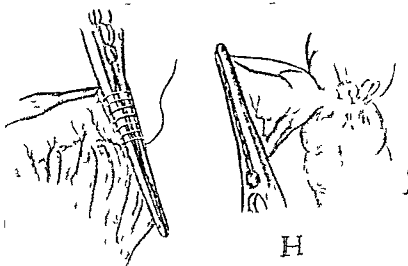


Fig 106 —Loop of ileum is folded together divided by cautery between obliquely placed clamps and then with resected mesentery closed by rows of sutures *H* applied behind and over the clamp as in Figure 104 *c d e f*

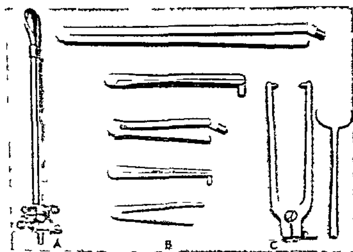


Fig 107 —*A* clamp h lde to facilitate placement and ma ipulation of clamps in depths of wou d *B* mod fications of deMartel and Stone clamp used for aseptic gastro- ntest nal anastomosis *C* compression yoke with removable key desirabl occasionally to increase compression of the longer gastric clamps and especially f r lateral resections of stomach when the locking dog' cannot be used.

With the hand in the abdomen as a guide, the appendix and meso appendix are pulled through a 1 or 2 cm stab wound Dressings are applied, the tip of the appendix or of a cone of cecum is cut off, and a no 14 F catheter is passed into the cecum, tied in, and kept open by irrigation Otherwise, should a patient develop abdominal cramps with localized or diffuse intestinal distention not relieved by Wangensteen aspiration, the author promptly deflates by tying a no 14 F catheter in the appendix or distended bowel A small muscle splitting incision made under local anesthesia is used Gentle irrigations are continued with weak hydrogen peroxide until the bowel empties Such operations done without delay have a low mortality and may be life saving The Miller Abbott tube is not advised for colonic obstruction

Sixty five resections, 35 of the stomach and 30 of the intestine, have been done by aseptic single clamp methods There were nine end to end resections of the transverse colon or its flexures, eight of the ileum, cecum and ascending colon, eight of the sigmoid or rectosigmoid one of nearly 9 ft of ileum for carcinoid obstructing bowel and blood supply, one of both jejunum and transverse colon one of both sigmoid and ileum and two of both ileum and rectum All intestinal resections were for carcinoma except one for ileoperineal and rectoperineal fistulas following operations elsewhere for lympho granuloma

Despite the number of necrotic carcinomas removed, there were only two operative infections of the abdominal wound and one localized intraperitoneal abscess (end to end resection of the sigmoid) Most patients were permitted out of bed by the fifth to eighth postoperative day and allowed to go home on the eleventh to fourteenth day

In the gastric series four patients died in the hospital The first died of a true lobar pneumonia eight days after complete gastrectomy for lymphosarcoma which ex

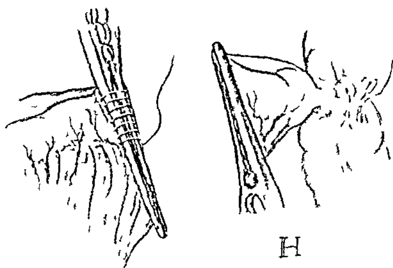


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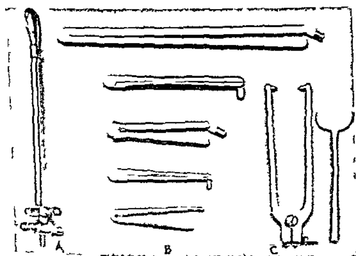


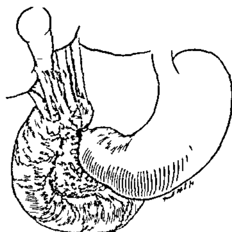
Fig 107—*A* clamp holder to facilitate placement and manipulation of clamps in depths of wound *B* modifications of deMartel and Stone clamp used for aseptic gastro-intestinal anastomosis *C* compression yoke with removable key desirable occasionally to increase compression of the longer gastric clamps and especially for lateral resections of stomach when the locking dog' cannot be used

tended into both the esophagus and the duodenum and the second of bronchopneumonia, gastric hemorrhage and purulent infiltration about the duodenum, following partial gastrectomy for subacute perforation of a chronic duodenal ulcer The third and fourth patients had post operative pancreatitis with extensive fat necrosis In the intestinal series there was one death from renal suppression and ileus without peritonitis which may be attributed to the operation Two patients died in the hospital due to progression of advanced ineradicable carcinoma The fourth death in the intestinal series (man, 74) occurred suddenly from intravenous use of 5 per cent glucose after resection of 110 cm ileocecum A glucose infusion several days previously had been stopped on account of precordial distress At the second infusion the symptoms recurred, but the glucose infusion was not discontinued

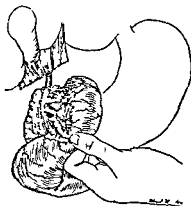
Arthur W Allen[4] (Harvard Univ) finds that *subtotal gastrectomy for stenosing duodenal ulcer* can usually be accomplished with little difficulty and with a low mortality rate in the average patient who has had suitable preparation At the time of operation, the surgeon must decide on the procedure best suited to the particular case The extent of the reaction about the ulcer site, the condition of the patient and other technical hazards must be weighed The lateral border of the duodenum may be freed without harm and the course of the common bile duct determined without disturbing the protective adhesions about a penetrating ulcer (Figs 108 and 109) Often the duodenum is foreshortened and drawn into the liver sulcus This should not be tampered with until the decision has been reached that a sufficient amount of normal duodenum remains between the ulcer and the papilla of Vater to allow adequate closure of the duodenal stump If, on inspection, it is found that the inflammatory reaction in

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volves too much of this area for comfort, one should immediately resort to one form or another of the exclusion operation Occasionally there is sufficient duodenum beyond the pylorus but proximal to the ulcer for adequate closure This can be safely met by leaving the ulcer in place, since with the duodenum adequately closed above it the ultimate result will be satisfactory


Fig 108 —Typical stenosing duodenal ulcer old adhesions not interfering with ideal operation.

The technic of operation for subtotal gastrectomy for duodenal ulcer is varied by different surgeons Some begin by freeing the duodenum and closing the remaining duodenal segment Often, however, the difficult part of the operation is easier if approached from the other direction For this reason Allen has routinely freed the gastric segment and transected it prior to dissection in the region of the ulcer This method allows free exposure of all sides of the inflammatory area and makes it possible to remove this segment under direct vision There is better control of the situation when this is done One can easily avoid undue injury to the adher


Fig 109 —Exposure of region of common duct by turning duodenum mesially assuring adequate amount of uninvolved duodenum below ulcer site

cut pancreas and keep in view the bile ducts and other structures in this area with more assurance If one elects to free the stomach segment first, it is made easier for the operator if he stands on the patient's left side By freeing the greater curvature in the beginning one can, by placing the left hand behind the stomach, control the left gastric vessels on the lesser curvature with greater facility

Fine chromicized catgut on atraumatic needles is satisfactory for the suture lines Great care is used to infold all mucosa since healing of these structures takes place only from the serous layer Thus a loose but firm approximation of the outer surface of these segments is desirable If one keeps this in mind, along with adequate control of bleeding healing will take place quickly and hemorrhage from the cut surfaces will be insignificant

There is much discussion regarding anterior or posterior anastomosis following subtotal gastrectomy In Allen's clinic during 1941 subtotal gastrectomy for ulcer was performed on 49 patients About two thirds had posterior and one third anterior anastomosis All have done equally well as far as immediate convalescence is concerned Allen prefers the short loop posterior hook up in the virgin case with a normal mesocolon that is not thickened by fat deposit In obese persons and those who have had previous posterior anastomosis he prefers antecolic gastrojejunostomy In many of those having had anterior anastomosis he has noted troublesome regurgitation of bile from the long proximal segment when the patient reclines at the end of the day during convalescence This complication is not of great importance and usually subsides after a few weeks Under no circumstances should one be tempted to relieve this situation in ulcer patients by entero enterostomy between the jejunal loops, since this will result in anastomotic ulcer in a large percentage of cases

If one allows the stomach segment to become acutely

distended, it will take some time for its tone to return, and this, added to the usual early lack of peristaltic activity in the remaining stomach, delays convalescence In patients who must be subjected to surgery at a minimal level of safety, as regards blood chemistry and inanition, it is wise to provide concomitant jejunostomy for feeding If this has been omitted at the original operation and the stoma fails to function for seven days after operation, jejunostomy for feeding should be done This procedure will allow easy restoration of fluid and chemical balance, which is not only life saving, but enhances the proper functioning of the anastomosis

Patients who have long been disabled periodically or continuously from duodenal ulcer will soon regain self-confidence after radical surgery It requires 3 to 12 months for some of these persons to acquire an appetite and begin to gain weight The majority can carry on their usual occupation after three months' convalescence and live comfortably on three regular meals a day For a time, many of them find it best to eat smaller meals more frequently, but seldom is it necessary to carry this out indefinitely All are discharged on a six meal bland diet and are given instructions regarding abstinence from highly seasoned foods, alcohol and tobacco Many of them find that these restrictions are unnecessary Although early follow up results, three to nine years, would indicate that recurrent ulcer is unusual, Allen feels that these people should regard their apparent good health without complacency

Total Gastrectomy—Charles Bruce Morton, II[5] (Univ of Virginia) believes preoperative treatment to be one of the most important factors in the safety of the operation The patient's general physiologic status is determined and every effort made to correct any abnormality The gastro intestinal tract is then prepared, usually for at least two days The patient with gastric

(5) Surg Gynec & Obst. 5 369 373 September 194?

stasis is allowed nothing by mouth, and fluid balance is maintained by solutions of glucose and sodium chloride intravenously The patient without gastric stasis is permitted clear, strained liquids by mouth and, in addition, one intravenous injection of 1,000 to 1,500 cc glucose or sodium chloride solution each day In all patients gastric lavage is done each night, and preparations are made for at least one or two blood transfusions (500 cc each) The night before operation, some



Fig 110 (left) —Traction sutures increase width of esophagus as outer posterior row of suture is placed to unite jejunum and posterior wall of esophagus
Fig 111 (right) —Inner posterior row of suture progressing to unite mucosal aspects of jejunum and posterior wall of esophagus

barbiturate is given, and nothing by mouth is allowed In the morning at least an hour before operation, a small caliber stomach tube is introduced through the nose, passed into the stomach and attached to a negative pressure apparatus With proper sedation, the patient arrives in the operating room in a drowsy state

Pontocaine 20 mg dissolved in 4 cc of a mixture of equal parts spinal fluid and 5 per cent solution of glucose, injected in the subarachnoid space between the

last dorsal and first lumbar vertebrae, has proved an ideal anesthetic Immediately after injection, the table is tilted, head down, at a 10 15 degree angle, until the



Fig 11 —Inner anterior row of suture progressing to unite mucosal aspect of jejunum and anterior wall of esophagus Dotted line shows last part of anterior esophageal wall which is to be sectioned and sutured thus completing inner anterior row of suture

level of anesthesia determined by pricking the skin, reaches just below the nipples This usually takes three to five minutes, after which the table is leveled and the anesthesia remains fixed usually for three or four hours

TECHNIC —Incision in the middle of the abdomen from the xiphoid process to the umbilicus provides excellent exposure. Thorough exploration must be done to determine the extent of gastric invasion and whether there is ineradicable metastasis. If complete eradication of the tumor seems possible by total gastrectomy, the operation proceeds The patient's condition is watched carefully, and fluids and blood are introduced intravenously as indicated With traction on the stomach, the peritoneum on each side of its cardiac orifice is incised and a finger gently worked around to encircle the esophagus and permit a tape to be passed around its lower end Severance of the peritoneal attachment of the left lobe of the liver to the diaphragm sometimes facilitates exposure Next the first portion of the duodenum is freed by sharp dissection Vessels are clamped, sectioned and ligated with fine silk, first in the gastrocolic and then in the gastrohepatic omentum so that they may be entirely removed with the stomach The lienogastric vessels are sectioned at the spleen to insure removal of lymph channels and glands found among them The left gastric vessels are sectioned as close to the celiac axis as possible so that lymphatic tissue in that region may be radically removed The stomach now lies entirely free, and traction on it will usually pull down a generous part of the lower end of the esophagus and provide surprisingly good exposure

A slit is made in the transverse mesocolon, down to the ligament of Treitz, which is severed so that an appropriate length of the first portion of the jejunum may be brought up for later anastomosis with the esophagus The slit is partly closed by suture with fine silk to the mesentery of the jejunum passing through it, and the efferent loop of the jejunum is loosely sutured obliquely through the anterior part of the slit, thereby closing the remainder of the opening

In addition to the towels used to cover the skin margins, the wound edges are covered by infolded laparotomy pads and the intraperitoneal operative field is carefully isolated in the same manner The first portion of the duodenum is severed between clamps 2 or 3 cm distal to the pylorus and the distal end is closed by inverting sutures of chromic catgut and is buried in the head of the pancreas The stomach is folded upward on the chest and a row of chromic catgut sutures used to suture the posterior aspect of the peak of the jejunal loop to the pillars of the diaphragm behind the esophagus with the efferent loop directed toward the patient's right side Allis forceps or traction sutures placed on each side of the cardiac orifice are used to attain the maximal width of esophagus so that the outside row of chromic catgut sutures for the end to side esophagojejunal anastomosis may be placed pos

teriorly (Fig 110) Next a small opening is made in both esophagus and jejunum, and a suture of chromic catgut, with a small, curved, swaged needle on each end is placed to begin the posterior part of the inner suture line At this point



Fig 113 —Outer a terior row f sutu e c mpleting esophagojejunal end to side anastomosis

the tube in the esophagus is grasped, withdrawn from the stomach and introduced into the efferent loop of jejunum so that the multiple large perforations in the tube remain at the region of the anastomosis The other end of the tube, attached to a negative pressure pump keeps the field of anastomosis

dry and clean As the sutures of the inner row are placed the openings in the esophagus and jejunum are enlarged (Fig 111) until the entire posterior row is completed Traction on the still attached stomach keeps the esophagus well down so that suture is not difficult As the anterior suture progresses by the Connell method from each side toward the center, the anterior wall of the esophagus is more nearly severed (Fig 112) and is finally completely severed as the last suture is placed and the knot tied, completing the anterior part of the



Fig 114 —Final step suture of jejunum to pillars of diaphragm anteriorly completes operation

inner suture line The end of the suture used for the posterior part of the outer suture line is then used to complete the anterior part of the outer suture line (Fig 113) Finally, the end of the suture first used to suture the posterior side of the jejunal loop to the pillars of the diaphragm is continued to suture the anterior side of the jejunal loop to the diaphragm in front of the esophagus (Fig 114) The suture of the jejunal loop to the diaphragm all around the anastomosis itself relieves the anastomosis of all tension and is an essential feature

The anastomosis and disposition of the jejunum as described leaves the shortest kind of afferent loop all above the trans

verse mesocolon, and consequently an equally short efferent loop passing through the mesocolon By this method there is no logical place for, nor need of, an entero anastomosis A jejunostomy tube may be placed lower in the jejunum for feeding if desired, but it was not used in any of the patients operated on by this technic

The incision is closed without drainage of the peritoneum though small, soft rubber drains are placed in the subcutaneous tissue between the stay sutures These are removed with the skin sutures in five to seven days

Postoperative care is most important Essential measures are constantly maintained negative pressure in the tube placed at operation to aspirate continually all fluid material at the site of anastomosis, adequate sedation, use of fluids intravenously, parenteral administration of vitamins, and blood transfusions The tube may be removed in 7 to 10 days, and the next day sips of water by mouth are allowed During the next two or three days, the intake of liquid is increased fairly rapidly and then of soft foods and in about two weeks from operation a regular five meal type of diet is tolerated The meals must remain small and frequent for several weeks but soon both afferent and efferent jejunal loops dilate to form a stomach like reservoir so that regular and normal sized meals are well tolerated Any tendency toward anemia should be treated with liver extract, and vitamins probably should be recommended for a time

Follow up examination of all patients operated on by the technic demonstrated freedom from digestive symptoms, little or no anemia, excellent general health, a sense of well being and economic rehabilitation

Herman E Pearse[6] (Univ of Rochester) describes a method of *one stage resection of the duodenum and head of the pancreas* which restores continuity of the biliary and digestive tracts with only two anastomoses gastrojejunostomy and antiperistaltic cholecystojejunostomy, which reduce the intestinal suture lines from five to two apparently a minimum (Figs 115 and 116)

Woman 56, in good health until one year before admission developed burning and tenderness in the epigastrium, easy fatigability and exertional dyspnea She was thin, looked anemic and chronically ill and had a soft systolic murmur over the precordium In the epigastrium just to the right of the midportion, tenderness was present on deep palpation

(6) Surg Gynec. & Obst 75 333 336 September 194?

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the gastrohepatic omentum was dissected down Common bile duct and superior pancreaticoduodenal artery were ligated and divided Transverse colon was lifted up, Treitz s ligament divided and the duodenojejunal junction mobilized according to Lahey The colon was replaced, and, working in front of the transverse mesocolon, the third and fourth parts of the duodenum were freed by lifting up the middle colic and supe rior mesenteric vessels and rolling the bowel from beneath them The duodenojejunal junction was divided and distal jejunum turned back The inferior pancreaticoduodenal artery

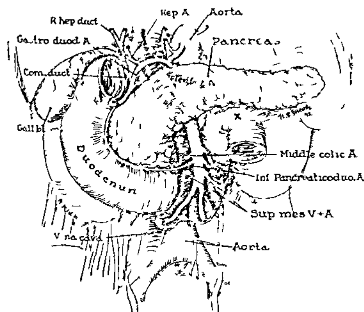


Fig 117 —Anatomy of d ssection When Treitz s ligament is cut and vessels supplying fourth part of duod num are ligated bowel will sl p under superior mesenteric and middle a. Th s is easily done if inferi r pancreat s are lifted up off duodenum the uncinate process of the art brought up to anastomose nt of superior mesenteric vein

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but no mass could be felt. Gastro intestinal roentgenograms showed fixation and infiltration of the duodenal loop which suggested a mass The impression was "carcinoma of the head of the pancreas or a mass originating in the duodenal loop" She was prepared for operation for 11 days by rest in bed high caloric diet, iron and liver and six transfusions totaling 2,900 cc whole blood.

Operation was done under ether anesthesia. A tumor was found on the posterior wall of the descending duodenum invading the head of the pancreas but without discernible metastases in the liver The cleavage plane under the pancreas was followed for a short distance when a hard gland was felt beyond the aorta so this dissection was stopped and a plane

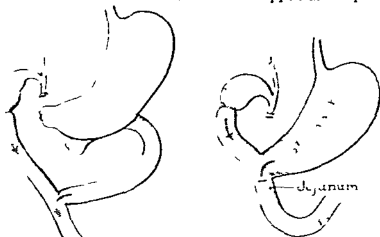


Fig 115 (left)—Anastomoses done in two-stage operation of Whipple. Fig 116 (right)—Simplified anastomosis. Physiologic principles are same as those of preceding

developed by freeing areolar tissue off the vena cava and aorta. This passed behind the gland. Large soft glands along the gastrohepatic omentum could be removed by cleaning all tissue off the bile duct, hepatic artery and portal vein Palpation of the pancreas showed the head invaded but division at the neck would certainly excise all involved tissue. The duodenum was infiltrated by tumor in its descending portion and appeared to be attached to the pancreatic growth in its third portion It was decided to do a bloc dissection starting below along the vena cava and aorta and above at the bifurcation of the hepatic bile duct including duodenum and head and uncinate process of the pancreas (Fig 117)

The stomach was divided near the pylorus and proximal part turned back out of the way The gland bearing tissue of

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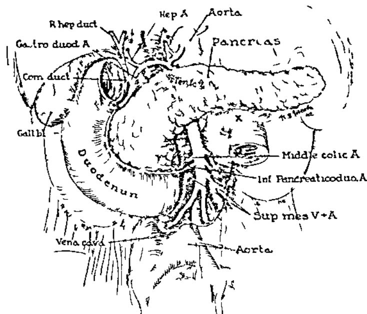


Fig 117 —Anatomy of dissection When Treitz s ligament is cut and vessels supplying fourth part of duodenum are ligated bowel will slip under superior mesenteric and middle colic vessels This is easily done if inferior pancreaticoduodenal artery is first ligated and these vessels are lifted up off duodenum with retractor This also assists in exposing the uncinate process of the pancreas Bowel is divided at X and distal part brought up to anastomose with gallbladder Pancreas divided just in front of superior mesenteric vein

was ligated and the head and uncinate process of the pancreas were mobilized This left the mass of tissue attached only by the neck of the pancreas which was then divided The neck was found to be only a thin sheet of tissue which could not be beveled in a V for inversion The cut surface was sutured as carefully as possible, however, closure was not completely satisfactory

To reconstruct the digestive tract Pearse to save time

but no mass could be felt Gastro intestinal roentgenograms showed fixation and infiltration of the duodenal loop which suggested a mass The impression was 'carcinoma of the head of the pancreas or a mass originating in the duodenal loop' She was prepared for operation for 11 days by rest in bed, high caloric diet, iron and liver and six transfusions totaling 2,900 cc whole blood

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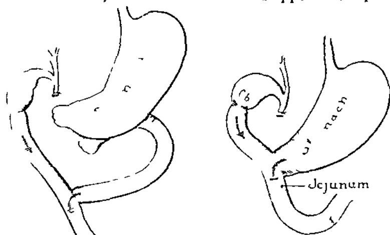


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specific gravity and plasma protein, permits intelligent administration of saline, plasma or whole blood and so gives the surgeon assurance of the patient's condition during long operations

The anastomosis described is only applicable if done in one stage when the entire duodenum is removed In several cadavers it was possible to roll the duodenum out from beneath the superior mesenteric vessels Before this, Treitz's ligament must be cut and in some subjects the vessels to the fourth part of the duodenum must be ligated and divided However then the mesentery of the jejunum is long enough to bring the bowel to the gallbladder without tension

Antiperistaltic attachment of the bowel to the biliary tract offers the best chance of avoiding ascending biliary infection The operation described appears to be the simplest way to do this, avoiding the complicated Roux anastomosis End to side gastrojejunostomy seems as good as the posterior side to side gastro enterostomy and is much easier, for the structures are clearly exposed It should be placed at least 6 in from the gallbladder suture to avoid reflux

It might be argued that resection of the entire duodenum is unnecessary and prolongs operation, but it is not hard to do and takes little time once the anatomy is visualized It has the advantage of giving a clearer view of the portal vein and pancreas than is obtained in any other way, which facilitates dissection of a region difficult to expose under other circumstances

Resection of the duodenum and head of the pancreas in one stage is applicable only in "good risk" cases In presence of debility, cachexia or severe jaundice, it is safer to do it in two stages

Charles S Ward Jr, and Frederick W Cooper, Jr [1] (Emory Univ) report a case of *atresia of the duodenum successfully treated by duodenoduodenostomy* Only 14 patients with complete atresia of the duodenum have

(1) Ann. Surg 117 718 7° May 1943

attached the open end of the proximal jejunum to the gall bladder and implanted the open end of the stomach, end to side, into the bowel below (Fig 118) Abdomen was closed without drainage by silk sutures

The patient made a satisfactory recovery until the seventh day when pancreatic juice was evacuated from wound A fistula developed which drained about 600 cc a day, but this gradually diminished until about 50 cc came from a small sinus This complication was attributed to the difficulty in

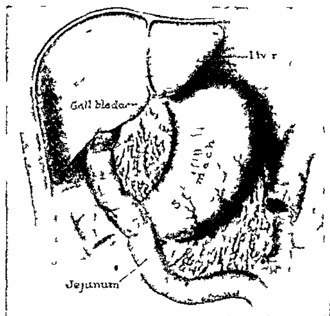


Fig 118 —Relation of viscera at end of operation. More jejunum than is shown should probably be left between gallbladder and stomach to prevent any reflux of gastric contents into biliary tract.

closing the thin neck of the pancreas She had episodes of chills and fever between periods of normal temperature for which no adequate explanation could be found She was kept in hospital for this, but was finally discharged the fifty eighth postoperative day Final diagnosis was carcinoma of the duodenum

Soon after this seven hour operation was started, a cannula was placed in a branch of the great saphenous vein from which blood samples were frequently taken and into which parenteral fluid and blood were given This method allows periodic determination of hematocrit,

delayed emptying of the stomach Weight gain and development at this time were found to be normal

In these cases, the entire small bowel should be inspected at operation because of the frequency of multiple anomalies of the intestine

Probably in no branch of surgery is pre and post operative management of the patient so important Use of a metal tipped gastroduodenal tube has recently been advocated Its greatest use should be at the time of ex

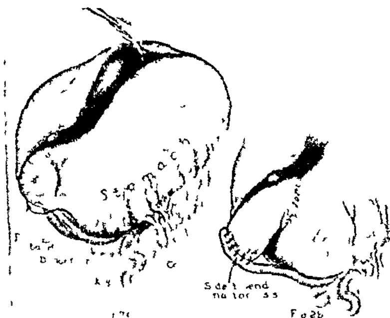


Fig 119—*a* Obstructed duodenum with intestine represented by fibrous cord *b* Operation side to-end anastomosis

ploration to eliminate the possibility of terminating an operation before the lumen is patent The degree of the patient's hydration should be carefully watched and free use of plasma and blood should be made as indicated by the plasma protein and hematocrit determinations

Diagnosis should be established as early as possible and operative intervention for re establishment of the continuity of the bowel delayed only for purposes of obtaining a better operative risk through hydration and

survived operation, and the literature reports no similar case in which duodenoduodenostomy was successfully performed

New born female, in whom breast feedings and dextrose water by mouth were begun six hours after birth and meconium was normal, started to vomit dark brown viscid material when 36 hours old and developed upper abdominal distention without visible peristalsis Appetite continued unimpaired A plain film of the abdomen revealed a greatly dilated stomach but no gas in the small intestine Barium by mouth filled the stomach and proximal duodenum, but none passed beyond the obstructed point A barium enema showed the position of the colon to be normal Clinical diagnosis was congenital obstruction of the duodenum To combat dehydration, a constant intravenous drip of dextrose and plasma was begun immediately Stomach contents were aspirated through a small rubber catheter

At the age of 5 days, under drop ether anesthesia the abdomen was entered through a right rectus, muscle splitting incision The stomach and proximal duodenum were markedly dilated There was complete atresia in the second portion of the duodenum with the duodenum represented by a fibrous cord for a distance of 2 cm (Fig 119*a*) The impression was that the atresia was distal to the papilla of Vater Because of the size of the structure the common bile duct was not identified The remaining intestine was collapsed and in normal position No bile was seen when the distal intestine was opened An anastomosis was performed between the end of the dilated second portion of the duodenum and the side of the third portion (Fig 119*b*) The anastomosis consisted of two layers of sutures (1) an external layer of interrupted no a silk serosal Lembert sutures and (2) a continuous internal no 00000 chromic catgut suture including all layers The peritoneum was closed with a continuous no 00 chromic catgut suture and the remainder of the wound closed in layers with interrupted black silk

Plasma and fluids were continued intravenously and the stomach was aspirated at frequent intervals The third postoperative day dextrose water was given by mouth, and the following day a milk formula There was occasional vomiting during the next four days Plasma protein level was 4 3 Gm per cent After administration of plasma, vomiting ceased A barium study of the stomach demonstrated a functioning anastomosis Recovery thereafter was uneventful At the age of 3 months barium studies showed no duodenal obstruction nor

Carcinoma of the jejunum is rare Maurice Kahn and Max W Bays[8] (Univ of Southern California) report two cases, in addition there were at the Cedars of Lebanon Hospital from May, 1930, to September, 1941, one case of carcinoma and one of sarcoma of the jejunum During the same period, there were 650 cases of carcinoma of the stomach and large intestine distributed as follows stomach 224, colon 234, rectum 192

Operative mortality is usually given as 20 per cent



Fig 190 —Barium filling jejunal diverticulum three hours after injection (D vegney Bailey p 394)

and average duration of life following operation as 17 6 months There are three forms of carcinoma of the jejunum the commonest being the annular constricting adenocarcinoma, next infiltrating ulcerative type, and last, polypoid type with intussusception as a not rare complication Usual site is in the proximal portion

(8) Am J Surg 58 145 14 Oct be 1942

transfusion Frequent aspiration of the contents of the stomach during the immediate postoperative period is a necessity because of the tendency of infants to swallow large quantities of air

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SMALL INTESTINE

A case of *diverticulum of the jejunum* is reported by F E C Devegney and Hamilton Bailey[7] (London) According to Edwards, jejunal diverticulum gives rise to two main symptoms vague abdominal discomfort and sometimes pain, particularly after meals, and flatulence, sometimes pronounced and associated with loud borborygmus

Obese woman, 56 for over 14 years complained of attacks of abdominal pain accompanied by flatulence In 1924 she had left nephrotomy for a large renal calculus, history about this time is confused by renal pain From 1926, attacks of upper abdominal pain, with flatulence relieved by bringing up gas and taking food, were well defined In 1926 laparotomy was performed after diagnosis of duodenal ulcer, but no ulcer was found, gallbladder was normal To 1939, attacks were treated symptomatically on assumption they were due to nervous dyspepsia

In 1939, after a particularly severe attack, roentgen examination showed a large jejunal diverticulum (Fig 120) 18 in from the gastrojejunal flexure Several small diverticula in the small intestine emptied with the intestine, but the large diverticulum retained barium for over 48 hours

At laparotomy under local anesthesia, despite many adhesions from the previous laparotomy, the diverticulum on the mesenteric border of the intestine extending into the mesentery, was easily located The segment containing the diverticulum was excised and continuity restored by end to end anastomosis reenforced by free omental graft She made uninterrupted recovery and remained free from her former symptoms, being in better health than at any time during the past 20 years

The diverticulum was about the size of a tangerine (Fig 121) Distended with water it held nearly ½ pt

(7) Brit M J 2 98 July 1940

obstruction must exist before the films disclose the condition Any marked delay in passage of barium through the small intestine suggests mechanical obstruction By taking x rays frequently, one may detect obstruction or filling defects that would be missed by the usual gastro intestinal pictures

CASE 1—Woman, 48 on Oct 24, 1932, complained of progressive weakness, loss of weight, anorexia, vomiting, pain and burning in epigastrium and fainting spells during the past year General physical examination showed emaciation, no masses were felt in the abdomen Anemia was marked Gastric analysis disclosed absence of hydrochloric acid Repeated tests for occult blood in the stools were positive Following administration of barium by mouth there was a marked six hour residue in stomach and duodenum Several transfusions of whole blood improved the anemia Preoperative diagnosis was tumor of the small intestine, probably malignant

The abdomen was opened through a right upper paramedian incision, retracting the rectus muscle laterally Ten in from the origin of the jejunum was a hard nodular tumor about 1 in in diameter There were several large glands in the adjacent mesentery and a few small palpable glands along the great vessels A V shaped resection of about 10 in jejunum with its mesentery was performed followed by end to end anastomosis She left the hospital with the wound well healed and no complaints on December 11

The specimen was a 29 cm segment of jejunum Surface of the tumor presented a depressed, partly annular scar extending approximately half its circumference The serosa otherwise was smooth and gray Scarred area was firm On opening, an annular ulcerating tumor extended over three quarters of the circumference about 3 cm long and elevated to about 0 6 cm Edges were nodular wavy and raised Base was granular and partly necrotic Microscopic section through tumor showed an adenocarcinoma infiltrated beyond the muscularis mucosae Structure did not suggest argentaffin tumor Lymph glands in the mesentery showed only hyperplasia no evidence of metastases Diagnosis was adenocarcinoma of the jejunum

May 3 1939, the patient returned complaining of bloody diarrhea of six months' duration Abdominoperineal resection for adenocarcinoma of the rectum was performed October 22 1941 she was of normal weight, comfortable and seemed well

CASE 2—Woman 62 entered the hospital with general peritonitis and died 27 hours later Autopsy showed general

Symptoms of cancer of the small intestine are indigestion, eructations, meteorism, feeling of fulness nausea, vomiting, epigastric distress, tenderness pain dull and aching but later cramplike, constipation, anorexia, asthenia, fatigability, loss of weight, melena rarely, occult blood in stools, tumor rarely palpable and anemia Perforation with peritonitis may occur

Many of these symptoms are common to various other



Fig 121 —Diverticulum on mesenteric border (Devegney Bailey p 394)

conditions Those most likely to lead to a correct diagnosis are epigastric distress, vomiting asthenia, loss of weight anemia and occult blood in the stools The last is significant if the stomach and large intestine are exculpated Short episodes of intestinal obstruction occur increasing in frequency and severity as obstruction becomes more pronounced

There are few methods of determining presence of small bowel tumor X ray appears the most valuable However as contents of the small gut are liquid, marked

applied experimentally and clinically with excellent results

Six cases are reported as examples Five hernias contained small bowel, and one contained omentum In all, the clinical course after operation bore out correctness of the prognosis based on the fluorescein, procaine hydrochloride tests or both In three cases only could patchy fluorescence be obtained in parts of the strangulated loop In two of these, procaine hydrochloride released the spasm In one this attempt failed, and resection was performed In two, judging from the gross appearance of the bowel resection seemed inevitable, but the combined fluorescein procaine hydrochloride test resulted in satisfactory restoration of circulation, thereby obviating resection Clinical course was uneventful, corroborating prognosis In one, a localized serosal defect failed to show fluorescence However, injection of procaine hydrochloride along the larger vessels caused appearance of fluorescence in the muscularis in a few seconds, giving evidence of return of blood supply to this region

In many animal experiments as well as in three of the cases it was evident that the contraction ring at the place of incarceration had not disappeared during observation, although this same area showed homogeneous fluorescence from the beginning Persistence of the contraction ring, therefore cannot be considered proof of nonviability of the bowel

[The editor has had no personal experience with these methods but their theoretical soundness would seem to make them of distinct advantage Any procedure which would help the surgeon to decide the sometimes difficult question of whether or not to resect should be a welcome addition to our armamentarium —Ed]

Intussusception —Andrew J Jackson and Joseph J Bowen, Jr [1] (Waterbury) state this is relatively uncommon It is primarily a disease of infancy and childhood In Children's Hospital, Boston between 1908 and 1932 Ladd and Gross report only 372 instances among 121,515

(7) Connecticut M J 6 916 920 December 194

peritonitis due to carcinoma of the jejunum with perforation about 18 in from the ligament of Treitz

John O Herrlin, Jr, S Thomas Glasser and Kurt Lange[9] (New York City) have used *two new methods to determine viability of bowel* in strangulated hernia at the time of operation the fluorescein test and local use of procaine hydrochloride

Fluorescein Test —After exposure of the questionable loop of bowel and release of strangulation, the operating room is slightly darkened and color of the intestines is observed under purple light Fatty parts of the mesentery may show a yellowish tint owing to a certain fluorescence inherent in adipose tissue Five to 6 cc of 5 per cent solution of fluorescein (in dogs 1 cc only is used) to which sodium bicarbonate is added to make a 5 per cent solution is rapidly injected intravenously The rays of an ultra violet bulb covered with a purple glass filter (Wood filter) are directed on the questionable loop This special filter permits passage of only a wavelength of 3 500 to 4,000 A, giving a dark purple light effect on the tissue After circulation time has elapsed, the fluorescein appears in the vessels of the bowel, producing a characteristic golden green illumination of only those areas sufficiently supplied with blood Districts which are not viable and accordingly out of circulation remain purple, while other segments inadequately supplied show markedly diminished illumination and often have a patchy character These effects are so conspicuous that the naked eye easily observes entrance of blood into the smaller vessels and spread into the serosa

Fluorescein seems to be nontoxic The authors have given up to 15 cc intravenously in clinical cases and have examined nearly 500 patients without observing reactions of any kind Fluorescein is rapidly excreted, and with normal renal function it is not visible in the plasma after five hours

Procaine Hydrochloride Test —Recent advances in knowledge of peripheral vascular diseases suggested application of the effects of procaine hydrochloride on circulatory changes in the bowel Marked objective changes can readily be accounted for by end results of vasospasm which in itself is reflex Furthermore, the established efficacy of procaine hydrochloride in releasing arterial and venous constrictions by inhibiting the autonomic impulses can be applied in the investigation of the circulatory competency of the intestine These principles were

(9) Arch Surg 45 785 791 November 1942

ing table as soon after admission as possible Adequate measures, however, may be carried out while preparations are being made for operation Reduction is done through a low midline or right paramedian rectus incision in such a manner in the abdomen that only the least amount of traction is exerted on the invaginated bowel Milking back of the intussusception through the intussuscepiens by most gentle manipulation is usually satisfactory until the ileocecal junction is encountered, when the remaining mass may be reduced outside the abdominal cavity By this technic reduction was adequate in 83 per cent of Ladd and Gross s cases, and mortality of 27 per cent from 1908 to 1912 was reduced to 12 per cent from 1928 to 1932 The trend is away from surgical attempts to treat related conditions at the time of reduction After operation replacement and supportive therapy is continued

In the Boston report there is evidence that 28 of the 30 cases in which resection was performed were fatal Neither of the two survivors was an infant

A statistical review of the surgical problem of intussusception particularly regarding resection in infants, shows that operation is practiced in 47 to 100 per cent Successful reduction is obtained in 60 to 90 per cent at the time of operation Among those operated on, 17 5 63 6 per cent have other operative procedures performed Resections are done in 7 9 to 38 9 per cent of the operations There is a general mortality in intussusception with operation of 11 1 to 45 5 per cent Mortality increases to between 40 and 93 5 per cent when resection is done In infants, this mortality increases from 50 to 100 per cent Mortality is not only increased because of operative difficulties, it increases in proportion to the length of time from onset to operation, length of intussusception from the ileocecal valve to the rectum and temperature on admission It is decreased in proportion to the knowledge and experience of the surgeon Lessen

admissions, in Charity Hospital, New Orleans between 1905 and 1938, only 151 cases are reported by Kahle The disease is more common in males than females It may be enteric, ileo ileocolic, ileocecal or colocolic, the ileocecal and ileocolic being most frequent It may be multiple, retrograde or recurrent, single double or compound, *acute*, *subacute* or *chronic* *In 90 to 95 per cent* there is no organic pathology The most important and most frequent condition noted at the time of operation and felt to be responsible is an abnormally mobile mesentery to the terminal ileum and cecum The four signs of intussusception are abdominal pain, vomiting, bloody stool and a palpable abdominal mass The lower left abdomen is found empty (Dance's sign) On rectal examination a mass may be felt, appearance of blood on removing the finger is relatively diagnostic

A flat plate film of the abdomen reveals positive and negative signs of intussusception *Positive signs* are homogeneous opacity of the intussusception, peripheral concentric ringing by translucent gas, conical stenosis of the small gut as it enters the intussusception and actual visualization of the tumor *Negative signs* of note are absence of the usual mottled appearance of the cecum due to gas and fecal contents and collection of gas in distended small gut loops in the region usually occupied by the cecum The barium enema under fluoroscopic visualization may show complete arrest of the enema, transient arrest of the head of the enema with gradual *movement proximal toward the cecum*, the emulsion creeping round the defect peripherally to become arrested, ensheathment with central defect, and the emulsion entering the central cylinder The enema may further demonstrate complete reduction of the intussusception, thereby obviating surgery

Wangensteen states that early reduction by operation is preferable Preoperative preparation should not interfere with the attempt to bring the infant to the operat

cinoid of the small bowel and a carcinoma of the sigmoid

The patient in whom the jejunum had intussuscepted into the stomach through a gastro enterostomy opening was treated medically and died The other nine patients were operated on, and two died One had Meckel's diverticulum and died of bronchopneumonia, and the other had carcinoma of the sigmoid and died of extreme thyrotoxicosis

Injuries—R E Waterston[3] reports a case of *intra mesenteric rupture of the small intestine*

Gunner, 20, collapsed and complained of severe abdominal pain after a football was driven with great force into the abdomen right of the midline Shortly after admission he vomited, pain continued and pulse increased steadily for 12 hours When seen 22 hours after injury, diagnosis was peritonitis following rupture of a viscus The patient stated his bladder was empty at the time of the accident, and it seemed likely that the rupture involved the intestine

Under general anesthesia the peritoneal cavity was opened through a lower paramedian incision and a quantity of serous free fluid with flakes of lymph was found The lowest loop of small intestine was bruised, with subperitoneal petechial hemorrhages and coagulum of lymph on its surface The maximal point of injury was some 8 in above the ileocecal valve, a subperitoneal swelling 1 in in diameter at the junction of gut and mesentery, ballooned out both anterior and posterior layers of the mesentery and was visible from both sides, peritoneum covering its upper and under surfaces was whitish, lusterless and edematous The intestine was ruptured into the mesentery and, as it seemed advisable to remove the affected portion to prevent spread of infection, the involved loop was resected and end to end anastomosis performed The incision was closed and the peritoneal cavity drained through a stab incision above the symphysis pubis Uninterrupted recovery followed

The resected loop presented a rupture through the intestinal wall into the space between the two peritoneal layers of the mesentery Perforation was roughly circular and connected the lumen of the intestine with a small space filled with intestinal debris This formed the swelling found at operation

The way the injury occurred is disputable Perhaps

(3) J Roy Army M Corps 8 8 89 June 194

ing of mortality seems to depend greatly on early diagnosis and treatment supplemented by supportive and replacement therapy before and during operation

The authors report a case of an infant, 7 months, who had symptoms for at least 40 hours before operation required intestinal resection and lateral anastomosis and recovered

Intussusception is comparatively rare in adults It has been estimated that only 5 10 per cent of all cases occur in adults Philip G Rowe[2] (Montreal Gen'l Hosp) describes 10 hitherto unreported cases in adults treated within the past 10 years

Clinically, two of the patients had acute and eight chronic intussusception Two of the latter developed acute symptoms immediately prior to operation In eight patients the intussusception was of the direct and in two of the retrograde type In one of the latter the ileum was involved, while in the other the jejunum had slipped into the stomach through a gastro enterostomy stoma

The ileum was most commonly involved, the intus susception being in this location in five cases The jejunum was involved in one case There were two cases of ileocolic intussusception and in two cases the sigmoid had slipped down into the rectum

Two cases were of the primary and eight of the secondary type The following primary lesions were found in the latter group In two a Meckel s diverticulum was definitely the cause while in a third it is felt that a Meckel s diverticulum found immediately above the in tussusception the predisposing factor In one case ap pendicular disease was apparently the basic factor in another a mesenteric gland was found to be the cause and in a third intussusception was secondary to a pre existing gastro enterostomy There were two cases in which tumor of the bowel caused the accident a car

(2) Canad M A J 4 219 2 5 September 194?

atgut tie about the base of the appendix allows amputa
ion of the organ flush with the purse string suture, thus
educing to a minimum the amount of stump to be in
erted

[If the stump is first tied obviously it can not be inverted rather
t is buried.—Ed]

*Conservatism in surgical management of acute re
gional enteritis* is recommended by H G Smithy[4]
who reviews five cases All were managed by simple ex
ploration and appendectomy, and none showed progres
sion of the disease That a strong tendency toward spon
taneous healing is present in certain instances is illus
trated by a case in which prompt healing followed
primary closure of a perforated cecum in the presence
of an active acute process Conservative management is
mechanically essential in a small group of acute cases
showing either massive involvement of the bowel or ex
tensive "skip areas" Spontaneous disappearance of
acute regional enteritis occurs in a large number of
cases and progression to the chronic phase in few Recur
rence after radical resection is relatively frequent, and
the mortality rate in patients subjected to radical
surgical treatment during the acute phase is formidable
To detect the occasional case in which there is a tendency
toward progression to chronic regional enteritis, con
scientious observation and frequent postoperative x ray
study are essential in the acute case managed by simple
exploration and appendectomy Observation and thor
ough preoperative preparation by general supportive
measures, transfusions and enteral chemotherapy, allow
ing progression from acute to chronic form, constitute a
far more desirable type of management than radical re
section in an unprepared patient with an acute case
recently admitted to the hospital Appendectomy is in
cidental in the conservative form of surgical treatment,
it does not materially increase the risk of fistula forma
tion If the appendix is not removed at operation,

(4) Surgery 13 12 130 January 1943

the injury affected the junction of gut and mesentery directly and, following formation of an intramesenteric hematoma, subsequent rupture of the intestine took place More likely, due to sudden increase in pressure in a distended loop of intestine, actual burst into the mesentery occurred at time of injury This supposes momentary obstruction of the intestine to the increased pressure above the injury—a small kink would be sufficient—the ileocecal valve forming the obstruction below Such a mechanism of rupture is described, but the usual site in these cases is on the antimesenteric margin In this case, rupture was incomplete in that the general peritoneal cavity was not immediately involved, accounting for the delay of about 20 hours in development of general peritonitis

Ileitis—Joseph A Hyams Sidney R Weinberg and John L Alley[2] (Columbia Univ) report a case of *chronic regional, nonspecific ileitis with concomitant ureteritis* While over 1 000 cases of the disease have been reported from all over the world in the decade since it was described by Crohn and his co workers, no urologic complications have been previously mentioned The mode of transmission of the infecting agent is unknown but there is a possibility of lymphatic drainage from the inflammatory mass in the intestines to the ureter It was also demonstrated that there was definite extrinsic pressure on the ureter from the granular mass of the ileum As soon as the focus of infection and the obstruction in the intestines were removed, the ureter returned to normal physiology and structure

John V Goode and Louis A Kregel[3] (Dallas Tex) studied the fate of the *appendical stump* in the dog Apparently, the size of the tied inverted stump determines the size of the resulting cecal pocket abscess, which is the chief objection to inversion of a tied appendical stump Substitution of a catgut purse string for the usual

(2) Am. J Surg 61 117 120 July 194
(3) Surgery 13 956 963 June 1943

abscess into the free peritoneal cavity Severe colitis developed in one patient in whom a resection had previously been performed In another patient, a universal enterocolitis developed after resection of an extensive segment of the bowel high in the ileum It is probable that the jejunum was involved at the time of the first operation

Distal ileitis is a surgical disease, in most cases marked amelioration of symptoms may be obtained by the sim

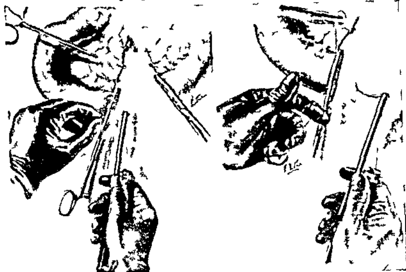


Fig 122 (left) —Basting stitch being placed below crushing clamp holding end of resected bowel stitch is hemostatic and prevents soiling
Fig 123 (right) —Basting stitch completed half loop in process of formation. (Goodman below)

pler operation of ileocolostomy with exclusion, which so far has not been attended by mortality

Technic —Henry I Goodman[7] (New York Polyclinic Hosp) compares the principles of exteriorization and direct anastomosis gives the respective advantages and disadvantages of the Mikulicz Paul procedure and discusses the importance of preoperative preparation which forms the basis of modern colon surgery Continued clinical experience is beginning to favor direct anasto

(7) Am J Surg 58 368 376 December 1942

eventual involvement of it by the acute granuloma may cause appendical obstruction from edema with consequent early rupture and peritonitis

On the basis of 77 operatively proved cases of *regional ileitis*, Leon Ginzburg and John H Garlock[5] (Mount Sinai Hosp, New York City) *stress the following* features

The surgeon must be certain that he is dealing with the localized form of the disease This requires careful inspection of the entire small intestine The bowel should be divided a good distance proximal to the diseased segment It is important to look for so called "skip" lesions Ileotransverse colostomy with exclusion, performed through a left rectus incision with the patient in the Trendelenburg position, is recommended Visualization of the various bowel segments is greatly simplified by this maneuver If resection becomes necessary later, it can be done through a right sided incision in a field devoid of the adhesions which result from the first operation It is not necessary to extend the resection to the transverse colon Resection at the level of the ascending colon is all that is needed Side to side ileocolostomy is the safest type of anastomosis

The authors urge the preoperative use of the Miller Abbott tube to serve both as a bowel decompressing agent and as a method of rapid orientation when extensive adhesions render intestinal topography difficult to visualize

Extension or recurrence of the disease will manifest itself within the first two years if it occurs The 7 failures in 54 cases in which the short circuiting operation was performed and the 3 failures in 23 cases in which resections were done occurred within that period There were three deaths among patients who could not be operated on by either procedure Two were due to extensive retroperitoneal infection and one to perforation of an

(5) Ann Surg 116 906 912 December 1942

Finger manipulation to make certain of the patency of the anastomosis completes the operation (Figs 122–127)

The amount of contamination which has resulted in suturing through the entire bowel thickness apparently has not made any material difference as far as infection is concerned There is no important difference when using this technic for colon resections The appendices epiploica may offer some problem, but by carefully dissecting them back and not too deeply, so as not to injure the underlying terminal artery, the surgeon can easily dispose of this problem This technic can be used equally well with silk cotton nylon or fine chromicized catgut

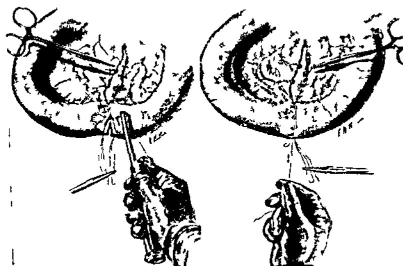


Fig 126 (left) —Placing of horizontal mattress sutures approximates cut ends of bowel over basting stitches on each end of bowel
Fig 127 (right) —Single strand being pulled out note corresponding loop becoming smaller With removal of both basting stitches temporarily closed ends of bowel will again be open Technic of the aseptic anastomosis now completed

The following advantages are claimed for this technic (1) The lateral locked stitch is readily placed with the Singer surgical stitching instrument (2) This retention stitch effectively controls leakage and hemorrhage from the resected ends of the bowel (3) In certain

mosis Goodman proposes that the term closed anastomosis be substituted for aseptic anastomosis and presents a *new technic of closed anastomosis*

TECHNIC —A lateral locked stitch is placed with the Singer surgical stitching instrument a few millimeters below the clamp holding the resected bowel The beginning of the stitch is not tied but is held in a fixed position by a small anchoring hemostat When this stitch has traversed the full width of

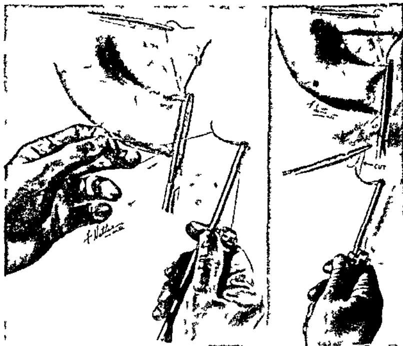


Fig 124 (left) —Detail of half loop fixing stitches temporarily
Fig 125 (right) —Strands of half lock stitch held as traction suture loop and single strand so arranged that entire basting stitch can be removed readily by pulling on single strand alone

the bowel it is temporarily fixed by an incompleted half locked stitch The crushed portion of the bowel held in the clamps is removed before beginning the anastomosis so as to reduce still further the possibility of infection in the suture line With the use of this retaining stitch, the size of the resulting diaphragm is extremely small After the mattress sutures have been placed the clamp is released from the incompleted half locked stitch Pulling on the retention stitch in the same direction in which it was placed removes it easily

Wangensteen describes a new operative technic for use in the bowel obstruction problem aseptic decompressive suction enterotomy The principle is essentially that of the Monks operation but there are less trauma to the bowel and reasonable assurance of the procedure being performed aseptically and without spillage The instrument used is built along the lines of an empyema evacuating trochar (Figs 129 and 130) Whether the

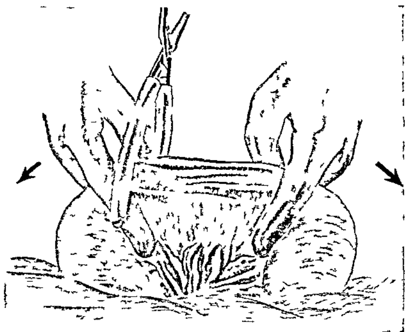


Fig 1 8 —Method of stripping a distended segment of small intestine which may be delivered onto the abdominal wall prior to performance of enterostomy

procedure will provoke shock remains to be determined No evidence of shock has been observed in the four patients in whom the method has been used

TECHNIC —This is shown in Figures 129 and 130 It is important that the segment of bowel into which the trochar is to be introduced is emptied effectually (Fig 128) before sutures are placed A no 22 F rectal tube is stiff enough to be advanced without difficulty into the dilated intestinal coils The catheter has multiple small perforations, not unlike the Kenyon Pool metal abdominal suction tube Nevertheless it

situations in which accessibility is limited and crushing clamps are placed with difficulty, a double row of retention stitches may be placed and the bowel transected between them (4) Hardly any crushed tissue need be turned in when making the anastomosis Thus infection in the suture line can be minimized because no devitalized tissue will exist to encourage bacterial growth (5) Because the stitch is sparing with the amount of tissue it requires for its placement, only a small diaphragm is formed at the site of anastomosis (6) This technic is applicable to various sized structures (7) The retention stitch is readily removed without incurring tissue trauma (8) The same instrument, by changing the needle, may be used for making the anastomosis and closing the incision

Aseptic Decompressive Suction Enterotomy—Owen H Wangensteen[8] (Univ of Minnesota) finds that despite general improvement in results of treatment of acute intestinal obstruction, surgical clinics professing a special interest in the problem still report persistent mortality varying from 12 to 20 per cent Strangulating obstructions and late cases of simple obstruction with great distentions contribute largely to this residual mortality There is, however, a definite mortality of treatment which should be identified Too enthusiastic reliance on suction management contributes to mortality of treatment Reduction in residual mortality must come about largely through improvement of surgical technics Aseptic surgical decompressions are mandatory for success How a surgical tap of a distended obstructed intestine is done is equally as important as choice of procedure The experience of Wangensteen's clinic with nonviable strangulated bowel suggests that primary intestinal resection with oblique end to end anastomosis the closed technic being used is safe and satisfactory In a year, there were no deaths in nine consecutive patients with nonviable strangulated bowel

(8) Surg Gynec & Obst 75 675 69 December 1942

of reducing distention so that the surgeon may see and deal with the agency which is causing the obstruction

As distended loops of bowel are emptied, they are reefed gently on the catheter in the bowel, thus permitting advancement of the catheter into more proximal reaches of distended intestinal coils When distention is essentially gaseous, external pressure on the distended intestinal coils, combined with suction, suffices to effect decompression, when distention is largely fluid, gentle elevation or tilting of the coils will cause fluid contents to run in the direction of the advancing

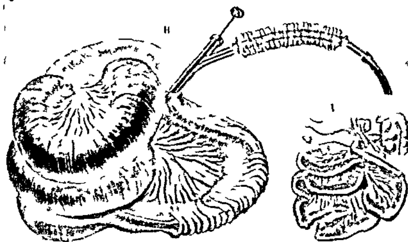


Fig 130 —Technic of aseptic decompressive suction enterotomy A distended intestinal coils. B intestinal loop near conjectured site of obstruction is delivered and segregated between rubber covered intestinal clamps after being stripped as indicated in Figure 128 A purse string suture is placed and an incision transverse to its axis made in bowel wall down to mucosa C length of incision D trochar thrust into bowel and purse string tied T tube with sidearm held vertically permits operator to make and break suction if intestinal mucosa tends to cling to perforations in tube Trochar accommodates a no 22 F long rectal tube Penrose drain with glycerin in it facilitates manipulation of rectal tube and prevents soiling or spillage E trochar in operation sectional view small perforations in catheter preclude bowel injury during suction F intestinal trochar G closure of enterotomy opening with interrupted Halsted mattress sutures of fine silk after obstructive agency has been dealt with H intestinal evacuation by mild suction applied to intestinal trochar I volumetric reduction by intestinal evacuation permits determination of nature of obstructing mechanism

suction tube The catheter may be withdrawn from the bowel and advanced in the other direction if desired The Penrose drain overlying the no 22 F *suction tube* (*Figs 129 and 130*) precludes contamination of the surgeon s hands on withdrawal of the tube Mineral oil (or better glycerin) in the Penrose drain facilitates manipulation of the suction tube within it

may be necessary to break the suction at intervals to obviate plugging of the holes in the tube by intestinal mucosa Wangensteen uses the ordinary bedside two or three bottle water siphonage apparatus to secure suction, but a Sprengel water pump will do A mild source of suction appears most efficacious

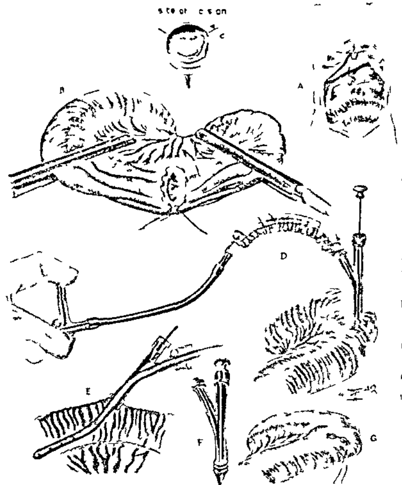


Fig 1 9 —For legend see Figure 130

cious In contradistinction to the Monks Moynihan maneuver, practically all the manipulation concerns loops of bowel which *have been emptied by suction* Monks devised intestinal evacuation to wash out toxic material from the distended bowel Wangensteen uses intestinal evacuation with the sole purpose

was admitted with marked abdominal distention, severe cramps and vomiting Roentgen examination revealed marked small bowel distention For the next six days repeated attempts were made to pass the Miller Abbott tube, but when it reached the midportion of the stomach it was deflected to the left, even when the stilet was used He was believed to have a prominent vertebral column responsible for the deflection With this in mind, the described method was used, and in four hours a free return of thick, green bile was obtained In six hours the tube was well along the small bowel Symptoms immediately subsided, abdomen decreased in circumference from 74 to 67 cm (around the umbilicus), and in eight hours he was asking for food, which was taken avidly and without distress In 12 hours he had a large normal bowel movement, the first in 8 days

Progress was rapid and uneventful, the tube was removed the end of the first day, and in five days he was discharged feeling well He had a general diet and passed formed stools daily during the last three days in hospital

Terminal ileostomy in ulcerative colitis—Many patients with idiopathic ulcerative colitis respond satisfactorily to well planned and prolonged medical treatment No specific therapy has been devised, and success of a particular remedy, such as sulfapyridine, sulfaguanidine, Bargen's serum or antidysenteric serum, is no proof of its specificity Indications for operation are difficult to define, because the disease is so protean in its manifestations and in the way it responds to orthodox and other types of treatment Nevertheless, surgery seems indicated when efficient medical treatment has failed to cure or produce relief, and when certain complications have occurred, such as subacute perforation or abscess fistula sinuses, obstruction massive hemorrhage or polyposis, or when the possibility of malignancy cannot be excluded The first group includes patients who do not respond to the best continuous medical treatment for six months and ambulatory patients with chronic involvement who are totally incapacitated three months or more each year

Rodney Maingot[1] (Southend General and Royal

(1) Lancet 2 1[illegible]1 1[illegible]4 Aug 1 194[illegible]

David Metheny and Lewis R Hutchins[9] (Seattle) recommend *use of gravity and the Wangensteen tip when Miller Abbott intubation* fails The Wangensteen tip gives the desired additional weight and the Trendelen burg position allows the tip to pass somewhat down as it travels through the pyloric portion Sims's position overcomes the anterior bulge produced by the vertebrae and large retroperitoneal vessels The combined effects of these positions place the distal portion of the stomach in its most dependent position, which is also useful when using the ordinary Miller Abbott tube


Fig 131

TECHNIC—For the difficult case the stomach is first deflated and thoroughly irrigated with warm 5 per cent sodium bicarbonate solution through a Levin tube After the contents have returned clear four to five minutes, a Miller Abbott tube with a Wangensteen tip (Fig 131) instead of the usual metal tip, is passed with the Levin tube still in the stomach If the nares are small, it may be necessary to pass the tube through the nose and out of the mouth before the tip is attached Then the tube is swallowed to the "60" mark Patient is then placed in the right Sims position and the foot of the bed ele vated 10 in The Levin tube is carefully with drawn, and for the next two hours the patient is given at least 2 qt warm water to drink suction being maintained continuously on the Miller Abbott tube At the end of this time he swallows the tube to midway between the "60' and '75' marks He drinks warm water 1 qt, for another hour then swallows the tube to the "75 mark. He drinks for another (fourth) hour and fluoroscopy is done

The tip will then be in the third part of the duodenum At this time 20 cc air is placed in the balloon and the air intake clamped tightly The bed is placed in the horizontal position The patient may now lie in any comfortable position during passage of the tube through the small bowel For this part of the procedure the accepted method of inflation of the bal loon is adhered to Care should be taken that the patient does not lie on the tube

CASE 1—Man, aged 76, with proved tuberculous peritonitis,

(9) West. J Surg 50 618 619 December 1942

drawn together around the projecting ileum so that its feeding blood vessels were not compressed or caught up in any stitch The ileum itself was not sutured to the peritoneum since a fistula is apt to result even when such sutures are introduced cautiously and take up only small bites of the seromuscular coats of the intestine The tension on such anchoring sutures may be great, with the result that they may

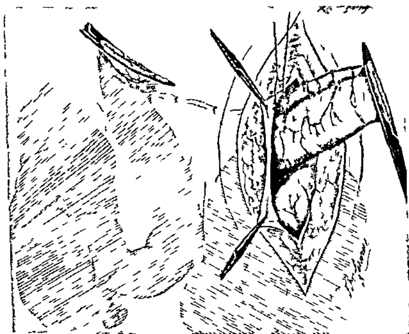


Fig 13 —Terminal transverse or divided ileostomy with implantation of limbs of th ileum into separate incisions in abdominal wall. Note method of anchoring divided mesentery to parietal peritoneum this prevents prolapse of intestine and safeguards against possibility of intestinal obstruction

cut out or lead to a localized area of gangrene, to subsequent perforation and peritonitis or to spreading suppuration in the *layers of the abdominal wall* The wound was closed snugly about the ileum, which was made to protrude about 2 in beyond the sutured incision After removing the clamp on the proximal ileal limb, a rubber tube about the size of an index finger was introduced into the intestine 3-4 in and stitched into position with a purse string suture of strong silk. The wounds and an area of surrounding abdominal wall were finally protected with wide sheets of flamed elastoplast

The patient made an uninterrupted recovery As the author

Waterloo Hosp) is convinced that the operation of choice is terminal ileostomy, preferably with implantation of proximal and distal ileal limbs into separate incisions in the abdominal wall Such operations as appendicostomy, cecostomy, etc, which were used to irrigate the large bowel, have now been more or less abandoned He describes a case of idiopathic ulcerative colitis which was successfully treated by terminal ileostomy, followed a year later by restoration of intestinal continuity

TECHNIC —Under cyclopropane anesthesia a vertical incision 3 in long was made over the lower half of the right rectus muscle at junction of inner and middle third, starting below and slightly to right of umbilicus The muscle was split in line with its fibers, the peritoneum was opened and each margin was picked up with hemostats and retracted, the last 2 ft of the ileum was drawn to surface of abdomen No exploration was conducted nor was the colon palpated to detect the extent of the disease lest infection be disseminated into the general peritoneal cavity The ileocecal junction was identified, and as the last few inches of the ileum were involved in the inflammatory process a portion of the intestine about 10 in from the ileocecal junction was selected for the ileostomy After identifying the lower reaches of the ileocecal artery, the ileomesentery was cautiously incised vertically on each side so that two or three of the arching blood vessels could be isolated tied off in two places and divided, thus allowing a fair degree of mobility when the intestine was transected with an electric cautery Through a small stab wound, made at the outer border of the right rectus muscle slightly above the upper margin of the first incision, a pair of curved artery forceps was passed to clamp the distal ileum Another hemostat was then applied through the original muscle splitting incision beside it on the proximal ileum, and the bowel was cut through with a cautery The distal ileal limb was immediately withdrawn through the stab incision and the skin edges were approximated with one or two interrupted sutures of fine silk The bowel was not stitched to the parietal peritoneum as the clamp was left in situ for five days, during which time the gut had opportunity to become firmly fixed to the small abdominal incision The proximal or functioning ileal limb was raised and the free edge of the mesentery was sutured to the under aspect of the peritoneum (Fig 132) The margins of the peritoneum and rectus muscle were then loosely

drawn together around the projecting ileum so that its feeding blood vessels were not compressed or caught up in any stitch The ileum itself was not sutured to the peritoneum since a fistula is apt to result even when such sutures are introduced cautiously and take up only small bites of the seromuscular coats of the intestine The tension on such anchoring sutures may be great, with the result that they may

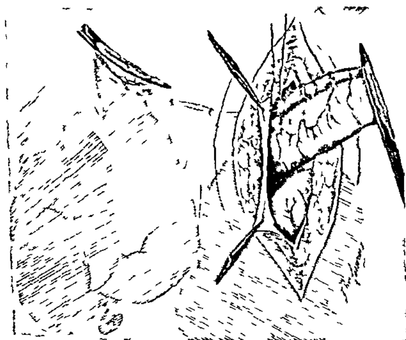


Fig 13 —Terminal transverse or divided ileostomy with implantation of limbs of the ileum into separate incisions in abdominal wall Note method of anchoring divided mesentery to parietal peritoneum this prevents prolapse of intestine and safeguards against possibility of intestinal obstruction

cut out or lead to a localized area of gangrene, to subsequent perforation and peritonitis or to spreading suppuration in the layers of the abdominal wall The wound was closed snugly about the ileum, which was made to protrude about 2 in beyond the sutured incision After removing the clamp on the proximal ileal limb, a rubber tube about the size of an index finger was introduced into the intestine 3-4 in and stitched into position with a purse string suture of strong silk The wounds and an area of surrounding abdominal wall were finally protected with wide sheets of flamed elastoplast

The patient made an uninterrupted recovery As the author

does not consider irrigations of the colon of any appreciable benefit in this disease, he made no use of the distal ileal fistula for this purpose Follow up during the next 12 months showed that the patient gained weight and that there was no discharge of blood or mucus through the anus As she was anxious to have the ileostomy closed, she was readmitted for further investigation a year after the terminal ileostomy The difficult problem is to decide whether or not the colitis can be regarded as healed

The patient had already gained 19 lb, looked well, was not anemic and had no discharge of blood, mucus or pus per anum, on sigmoidoscopy the mucous membrane of the rectum and lower sigmoid colon appeared normal and there was no evidence of contraction of the bowel Two liters of normal saline was injected into the colon and retained for a few minutes After this was expelled and collected, the fluid was centrifuged and the precipitate examined microscopically No pus cells or red blood corpuscles were found Barium enema x ray examinations of the excluded colon were then carried out, immediately after washing out the large bowel with salt solution and after a quantity of ileal feces had been injected through the distal or nonfunctioning ileostomy In the first series the whole colon looked tubular and contracted—lead pipe colon—and the usual haustral markings were absent, while in the second series haustrations were present throughout the large gut which although somewhat spastic and irritable, did not appear to possess an unduly narrow lumen in any part of its course

The final test consisted in introducing certain substances into the colon through a catheter passed into the distal ileal stoma to ascertain what the colon could tolerate The following were injected milk albumin water oatmeal gruel and then diluted ileal feces The feces which were discharged through the proximal ileostomy were collected and at first diluted with water then gradually made stronger until eventually the whole of the ileal discharge was introduced into the colon undiluted Ileal contents were well tolerated in the colon the bowels were evacuated once or twice a day, the stools being well formed and containing no blood or pus As there were no signs of a flare up of the active process after several days of testing and training the large gut, it was decided to rejoin the divided ileum

Under endotracheal gas oxygen ether anesthesia both ileostomy stumps were dissected from the abdominal wall, invaginated and closed and as the distal limb of the ileum was atrophied and somewhat sclerosed it was amputated about 1 in from the ileocecal junction the stump of the ileum being

invaginated into the capacious cecum through the ileocecal valve, and two purse string sutures of silk were used to close the defect in the cecal wall The appendix was long and tortuous and contained many fecaliths It was therefore amputated and its stump invaginated with a purse string suture The ileum which was prepared for anastomosis was then joined to the anterior aspect of the cecum and an isoperistaltic side to side anastomosis was fashioned with the aid of enterostomy clamps The abdominal incisions were approximated in layers and the wounds sealed off with adhesive plaster impregnated with sulfanilamide The wounds healed well, the bowels acted without enemas or aperients on the fourth postoperative day, and after that there were one or two daily evacuations while the patient was in the hospital She was well in every respect one year later

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VERMIFORM APPENDIX

Carl A Wattenberg and Peter Heinbecker[3] (Washington Univ) report that during the past four years at St Louis Children's Hospital the *mortality from acute appendicitis* and its complications has been reduced from 7 89 to 2 2 per cent There were 223 appendectomies or operations for appendicitis, with five deaths No deaths occurred following operations for acute unruptured appendicitis recurrent unruptured appendicitis or acute appendicitis with local peritonitis The five deaths resulted from appendicitis associated with diffuse peritonitis There were 32 cases of this type making the mortality rate 15 6 per cent During a previous period, this rate was 38 per cent

During 1940 and 1941 there were no deaths from appendicitis or its complications It was during this period that the new principles governing treatment of appendicitis were first used unfailingly The improved results are ascribed essentially to early removal of the appendix, intensive and well directed pre and postoperative care and adequate use of sulfonamides before and after operation

(3) Surgery 1? 76 583 October 194?

Keith J B Davis[4] (Tamworth, New South Wales) describes a *case of appendical abscess with unusual symptoms*

Child, 15 months, vomited and was fretful, but examination revealed no abnormality One week later, it had melena, temperature was 99 4 F, pulse 120, respirations 24, but examination was again negative Melena recurred the following day An attempt to give a barium enema failed. General condition was still fair, but the child was beginning to look exsanguinated It was decided a blood transfusion should be given

At laparotomy, two fingers were inserted through a small midline incision, and no mass was palpable, but as the fingers were exploring the right iliac fossa thick pus welled up The lesion was then recognized as appendical abscess, and a tube was placed in the right iliac fossa through a stab wound Sulfanilamide powder was dusted into the peritoneal cavity The wounds were closed with catgut and silkworm sutures and the patient returned to the ward in a poor condition

Meanwhile attempts had been made to give the blood transfusion, but they were unsuccessful in absence of veins, even though four attempts were made Subsequently blood was given intramuscularly into the buttocks, for its iron value

Three days later, as little discharge was coming through the tube, it was removed For two days a grayish discharge in small quantities continued to ooze from the stab wound The same day blood was again discharged from the rectum This continued at intervals for seven days sometimes the blood was mixed with feces, but was always dark The only measure found effective to control hemorrhage was barium solution as used for opaque enemas Eight days after removal of the tube there was some blood stained discharge from the stab wound This was bright, in contradistinction to the dark blood coming from the rectum This was succeeded by fecal discharge through the stab wound, which persisted for 25 days During the early stages of fecal discharge some constipation was present but eventually the bowels opened normally and the stab wound then healed

The interesting feature is the unusual symptom of severe and repeated melena and hemorrhage from the wound after establishment of the temporary fecal fistula, this indicates that a large vessel must have ruptured from the submucosa into the lumen of the cecum, thus

(4) M J Australia 2 70 Sept 19 1942

causing the melena When drainage was established, blood passed from the cecum to the abscess cavity and out through the stab wound

A case of *infectious nonspecific granuloma of the appendix* is reported by Aaron N Gorelik[5] (New York City)

Boy 9½, had pain in the right side of the abdomen for four days, starting suddenly in the pit of the stomach without nausea or vomiting and later localized in the right lower quadrant On palpation an irregular and indefinite mass was felt at times in this quadrant, and diagnosis was acute appendicitis At operation, a reddened and inflamed mass adherent to appendix and cecum was carefully dissected from the cecum up to the base of the appendix and removed with the latter The mass looked like a mucocele of the appendix The cecum was greatly congested and hypertrophied at the site of adherence The abdominal wall was closed in layers Postoperative course was uneventful

The specimen the size of a walnut, showed remnants of the appendix The rest of the tissue consisted of inflammatory connective tissue with areas of polynuclears and round cell exudate with some eosinophils Diagnosis was granuloma around an infected appendix

Infectious nonspecific granuloma is far more frequent than the literature suggests However that of the appendix is uncommon in adults and extremely rare in children It occurs in children in regions other than the appendix ileum and colon back genital organs and abdominal muscles Granulomas of the cecum or ileum following appendectomy have been reported This condition is directly due to a low grade infection, causing impairment of the circulation, followed again by a low grade infection In either case there is an inflammatory reaction characterized by necrosis and a reparative process acting and reacting, with a gradually increasing building up of an inflammatory mass until a granuloma reaching even the size of a cocoanut has formed Occasionally the reparative process predominates early, with constricting or stenosing granuloma

(5) M Rec. 155 519 5?1 December 194?

Appendicitis, diverticulitis, ulcers in the stomach or intestines, foreign bodies in the bowel lumen or wall, or lying in the abdomen, splinters penetrating into the abdomen etc, may be the nucleus for an infectious granuloma Trauma is a frequent cause, especially trauma which results in a tear of the mesentery which allows foreign material to remain in the abdominal cavity or undiagnosed and nonfatal perforation or laceration of the intestinal wall Extraperitoneal inflammation may spread to or involve the gastro intestinal tract and form a granulomatous mass

When the appendix is the source, it is buried in the cecal wall, in the terminal ileum, and forms part of the inflammatory mass Extension of inflammation is by contiguity, mainly pericecal, with involvement of sub serosal tissue The submucous layer of the gut does not appear to be involved Occasionally tiny abscesses between appendix and cecum will be uncovered when the former is mobilized, and fistulas running into the cecum may be found This type of lesion is quite common, its true nature is not usually appreciated, and resection is rarely performed The appendix and cecum show marked submucous thickening, edema and fibrosis the appendix participating simply as a component portion of the segment of gut

These conditions produce a few vague indefinite symptoms or no symptoms similar to chronic appendicitis Perforation of the appendix in cases with tumors of that organ is rare Symptoms are those of local infection, bowel obstruction and constitutional reaction Pain, tenderness rigidity and a mass are often present locally Intestinal obstruction occurs if the tumor encroaches on the bowel lumen Constitutional reactions include fever leukocytosis and loss of weight Diagnosis is rare except at operation or necropsy Often diagnosis is carcinoma syphilis or hyperplastic tuberculosis of the bowel More rarely they have been confused with amebic disease actinomycosis and bilharziasis

Treatment is surgical removal Sometimes simple surgical exposure of the mass, drainage or a side tracking operation of the intestines results in disappearance of the tumor Local removal, if possible, is advisable except when pus is present, here drainage is required If bowel obstruction is found, enterostomy or entero enterostomy is recommended

No tumor of the gastro intestinal tract, considered at operation as malignant and inoperable, should be abandoned without first obtaining a small section for biopsy and without trying to remove it, if possible This will prevent the fatal prognosis of carcinoma when the patient has only granuloma

[It hould be recalled in this connection that the important work of W J Mayo on diverticulitis of the sigmoid had its origin in the fact that he resected the sigmoid of another surgeon in the belief that the le ion was carcinoma Microscopic demonstration of the ab ence of carcinoma and instead of the presence of chronic in flammation originating in a diverticulum resulted in putting this condition on the surgical map —Ed]

Carcinoid Tumor of the Appendix—Review of the literature reveals that whereas carcinoid tumors of the stomach small intestine and colon are frequently classed as malignant, similar tumors in the appendix are regarded as essentially benign However, 16 metastasizing appendical carcinoids indicate that these seemingly innocent neoplasms are capable of widespread dissemination Richard A Hopping, Malcolm B Dockerty and James C Masson[6] (Mayo Clinic) report a case with manifest malignancy and extensive metastatic involvement of the right ovary, heretofore unreported

Woman 47, with weakness, hematuria and pain in the back for five years had had exploratory laparotomy at 26 and right nephrectomy for tumor at 41 Appetite had remained good and there had been no noticeable weight loss Essential positive observations were limited to the lower part of the abdomen, in which palpation revealed a sense of resistance, e pecially on the right where tenderness was elicited on pressure There was questionable dulness to percussion below the

(6) Arch Surg 45 61 6 October 1942

umbilicus Bimanual pelvic and abdominal examination disclosed a tender mass in the right adnexal region, not freely movable and not to be separated from the body of the uterus, which with the cervix was displaced to the left Rectal examination disclosed no intrinsic disease but confirmed presence of a semifixed tumor in the pelvis

Cystoscopic examination revealed granular urethritis and moderate cystitis Pyuria and bacilluria were present Retrograde urograms revealed an essentially normal left kidney and ureter The right ureteral stump showed a filling defect which suggested pressure from without by an invasive mass

With provisional diagnosis of malignant ovarian tumor, laparotomy was performed through a low midline incision The appendix was adherent over the right brim of the pelvis and contained a yellowish tumor 3 cm in diameter There was also a malignant solid tumor of the right ovary extensively adherent to surrounding structures The right iliac lymph nodes seemed grossly involved There were a lemon sized cyst of the left ovary and multiple fibroids of the uterus Operation was completed with dissection and removal of the right fallopian tube, ovary and appendix The left ovarian cyst was enucleated Iliac lymph nodes were not removed because of danger of tearing into the large iliac vessels to which they were densely adherent Biopsy of one node was made to complete the pathologic diagnosis

The patient returned home in 24 days, after a course of roentgen therapy

The distal half of the appendix was bulbous and almost completely replaced by a yellowish tumor nodule, 4×3×2 cm The right ovarian tumor was firm, yellowish brown and encapsulated, 10 cm in diameter, with many roughened adhesions visible externally Its appearance was wholly unlike that of any ovarian neoplasm ever examined by the authors, and metastatic carcinoid was considered The left ovarian cyst had the gross appearance of a dermoid cyst Microscopic sections from the appendical tumor revealed typical picture of carcinoid Cellular uniformity, relative lack of mitosis and differentiation into glandlike structures were typical of grade 1 lesions (Broders) This lesion was a widely metastasizing carcinoid, yet the microscopic pictures could be transposed verbatim to describe most of the so called benign examples Microscopic sections from the right ovary and iliac lymph node presented pictures in most details exactly similar to those of the appendical lesion

In 1939, Porter and Whelan reported 84 carcinoids (0 28 per cent of surgically removed appendixes) Car

cinoids were twice as common in the appendix as in the small bowel, and elsewhere in the gastro intestinal tract they were found (in decreasing order of frequency) in the stomach, gallbladder, duodenum, Meckel s diverticulum (if present), cecum and colon In 1938, Gnassi reported 5 carcinoids of the appendix in 4,224 surgical specimens In 1936, Jones described six carcinoids of the appendix, all in the distal portion, none had metastasized He expressed the opinion that they occurred five times as commonly in the appendix as in the small bowel, where according to the literature, 30 per cent were multiple In 1940, Schuldt reported that ordinary adenocarcinoma of the appendix had an incidence of 0 027 per cent, as compared to an incidence of 0 216 per cent for carcinoid of the appendix The authors have found it fairly common, occurring once in about every 200 surgically removed appendixes (0 5 per cent) In 50 per cent of cases, the tip of the appendix was the site of origin Most common in the appendix, carcinoids were found in decreasing order of frequency in the ileum cecum, jejunum, colon and stomach

The tumors are found among patients from childhood to senility No predilection according to sex has been noted All three germ layers have been variously considered to be the source of the tumor cells or their antecedents Probably most widely accepted now is the concept of entodermal origin It seems that carcinoid tumors are of glandular origin and are possibly derived from the argentaffin cells of the intestine

In various reports, incidence of invasion and metastasis in carcinoids of the small bowel is set at 20 to 25 per cent of the cases When in the stomach and large intestine, almost all are deemed malignant Clinically, the highest percentage of malignancy of carcinoid of the appendix was reported by Raiford (5 9 per cent) Pathologically, serosal involvement is common, but metastasis is rare When it occurs, it is usually local in mesenteric fat, regional lymph nodes and rarely, liver

Although the authors believe these tumors are adenocarcinomas grade 1 (Broders), they do not think that it would be wise to discard the designation "carcinoid" Diagnosis of grade 1 adenocarcinoma (carcinoid) appears to be accurate, to designate a specific entity and to separate it from the ordinary type of adenocarcinoma which has a somewhat worse prognosis

Enterobius Vermicularis in the Appendix —Various studies on incidence of this parasite in the appendix since Still's report in 1899 have shown wide variation Early reports in the American literature show an incidence of less than 1 per cent In 1925, Harris and Browne found 18 2 per cent of 121 appendixes infested, and figures given by other American investigators have ranged between these extremes An even greater variation is found in the foreign literature Therefore John R Schenken and Emma S Moss[7] studied incidence of the parasite in 1 000 surgically removed appendixes at Charity Hospital New Orleans using a standardized procedure, as adopted by parasitologists This requirement has not been sufficiently emphasized In most instances method of examination used was not discussed, but when noted it usually consisted of either gross examination of the content or microscopic examination of the tissue section In a few instances however, these methods were supplemented by microscopic examination of the content

Age and sex incidence of appendical infection by Enterobius vermicularis is emphasized in most available reports, but in none, so far as can be determined is there a comparative survey of incidence in Negro and white patients In addition only one paper on the importance of searching for the male form of Enterobius vermicularis in the appendix could be located

TECHNIC —Following gross examination of the appendix and its content, the complete content was delivered into a test tube and thoroughly emulsified in water In the first 600

(7) Am J Clin Path 12 509 1 October 194

cases (group 1) the specimen was centrifugalized for one minute at about 500 r p m, after which the supernatant fluid was discarded In the remaining 400 cases (group 2), the same procedure was used except that centrifugalization was repeated until the supernatant fluid was clear A clean sediment was thus assured which lent itself better to microscopic examination Value of repeated centrifugalization is apparent in the results

In both groups the *entire* sediment was transferred to slides, and cover slips were applied Each author examined every preparation from all specimens, and the various forms of the parasite were identified Presence of any form of the parasite was considered positive for Enterobius vermicularis

Infestation with Enterobius vermicularis was found in 23 3 per cent of all the appendixes, 42 1 per cent from white women and 38 3 per cent from white men were infested (group 2) and 10 1 per cent from Negro women and 12 8 per cent from Negro men (group 2) The findings in group 2 are regarded as more accurate than those in group 1 because of use of the improved method

E Kuitunen Ekbaum and E M Morgan[3] (Toronto) have examined 100 surgically removed appendixes from children aged 3 months to 14 years and found Enterobius vermicularis in 34, incidence being 40 per cent among 45 girls and 29 per cent among 55 boys No correlation was found between presence of the parasite and appendicitis, the parasite occurred in 27 normal appendixes, and in 5 cases of acute 1 of chronic and 1 of acute and chronic appendicitis The most pinworms, 200, were found in the normal appendix of a girl, 5 Ova were found in six appendixes apparently released from the dead atrophied pinworms The eggs were in the early stage of development Fecaliths were found in 11 acute appendixes and 1 normal organ

Diagnosis—N C Stevens[4] (Walpole N H) finds *auscultation of the abdomen valuable in diagnosis of acute appendicitis* At the beginning of an attack the

(3) Canad Pub Health J 33 340 343 July 194
(4) Am J Surg 60 365 3 0 June 1943

peristaltic rate is usually increased As inflammation progresses, peristalsis diminishes When the outer coat of the appendix becomes involved, peristalsis ceases altogether and the abdomen becomes silent Stevens has never seen a case of acute appendicitis at or near the time of rupture with a noisy abdomen Cessation of peristalsis seems to depend on infection or irritation of the peritoneum In cases of retrocecal appendicitis, peristalsis does not cease entirely, but becomes faint and muffled, which can best be described as "scratchy" Not all silent abdomens are due to peritonitis In some cases of acute indigestion there is spasm of the pylorus which seems to affect the motility of the gut In this condition no sounds are heard over a considerable period

[The importance of auscultation of the abdomen in the diagnosis of acute appendicitis and peritonitis was stressed for many years before his death by John B Deaver—Ed]

Hyperesthesia of the Posterior Peritoneum (Objective Pain) in Appendicitis and Other Visceral Lesions—Rafael Capurro[5] (Montevideo) noted in a series of chronic and acute appendicitis cases with little or no spasticity of the abdominal wall that deep palpation of the region of the iliac muscle just internal to and above the crest of the anterior iliac spine provokes a pain that is quite localized This painful reaction is completely independent of the position of the appendix, facilitates diagnosis and in certain cases determines it, and disappears after injection of 1 per cent novocain into the meso appendix

Considering the possibility that lesions of other organs might induce hyperesthesia in other regions of the posterior abdominal wall Capurro found that in salpingo oophoritis and epididymitis the zone of hyperesthesia is on the body of the first sacral vertebra near the sacral wing, in lesions of the stomach, duodenum and gallbladder on the bodies of the lumbar vertebrae at the

(5) Ann Surg 117 735 739 May 1943

level of the umbilicus, and in kidney lesions on the iliac crest at anterior axillary line lateral to the ureter

The question of the seat of pain was settled in three patients with appendicitis operated on under local anesthesia The peritoneum was freed from the iliac muscle, and digital pressure on the muscle induced no pain, whereas compression of the peritoneum between two fingers provoked the painful reaction which, in turn, was eliminated by novocain infiltration of the meso appendix The explanation lies in the fact that the parietal peritoneum is innervated by the spinal nerves In a lesion of the appendix, the visceral afferent nerves convey impulses to the spinal cord and connections are made with efferents to the eleventh and twelfth thoracic segments which are those involved in the innervation of the parietal peritoneum covering the iliac muscle Injection of novocain into the meso appendix eliminates the reflex at its source

Clinical application of this test has been made in 200 cases with 1 failure The negative result might be related to a retraction of the peritoneum toward the mid line found at operation

It must be realized that the deep palpation test is not possible in obese and neurotic patients and in those with hypersensitivity of the sympathetics It appears that the hyperesthesia of the posterior parietal peritoneum is more persistent than that of the anterior wall and is therefore maintained in lesions of long standing

Technic—Arthur F Bratrud[6] (Minneapolis) discusses *nonclosure of wounds in acute appendicitis and the use of the Gibson Mikulicz tampon* on the basis of a review of 339 cases of the disease Treatment should be individualized and Ochsner s old dictum that after 48 hours all patients with appendicitis should be treated by conservative measures should be abandoned Most such individuals should be operated on as soon as possi

(6) Minnesota Med 26 651 655 July 1943

ble However, when a patient is seen late and rectal examination shows an abscess in the culdesac, drainage by rectum should be instituted and an interim operation performed, as the mortality rate with this procedure is practically nil In a fulminating case, it is better to remove the appendix and use a McBurney incision with nonclosure of the wound plus rubber tissue drains or a Gibson Mikulicz tampon which should be removed from the second to the fourth day Drains after this period are of no value except to drain a limited area If a right rectus incision is used a Gibson Mikulicz tampon is indicated If such a tampon is not available, a rubber glove can be used in a similar manner Much too little attention has been paid to the recognition and treatment of acute appendicitis with peritonitis or abscess by the methods mentioned The mortality rate can be lowered by nonclosure of the wound and the use of rubber drains or a Gibson Mikulicz tampon besides there is never any infection, phlegmonous infiltration or sloughing of the tissues unless they have been traumatized There is less postoperative pain convalescence is smoother and the danger of evisceration and hernia is no greater with this method than when the wound has been sutured

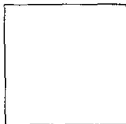


Fig 133 —Distribution of holes

METHOD —The Gibson Mikulicz tampon consists of an outer enveloping layer of dental rubber dam or gutta percha 12 20 in square depending on size of the cavity The rubber dam is folded in the form of a cornucopia its apex is cut off so as to leave a hole of about 1 cm in diameter, and similar areas on the sides are cut out 1 or 1½ in above and apart as shown in Figure 133 When the drain is inserted into the abdominal cavity, the index finger is placed at its apex and carried to the bottom of the cavity The edges of the rubber drain are then spread out and gauze strips are packed into the drain so that the intestines are held away from the wound edges The gauze is removed in 24 to 48 hours and the entire drain in 72 hours

By this time there is a well walled off cavity with wide open drainage and with the omentum and bowel held away from the wound edges

[It is interesting to read that this old procedure is still being used The editor was of the opinion that it had gone with the horse and buggy —Ed.]

Robert A Wise[1] (M C, U S A) solves the problem of *introducing sulfanilamide crystals into the peritoneal* cavity high in the right lumbar gutter or low in the pelvis through a Mc Burney incision by the following procedure The gauze packing of a cigaret drain is pulled back from one end for 2 in and crystals are poured into this end of the drain A sponge forceps is applied to the open end of the drain to hold the crystals in place (Fig 134) After the drain is inserted into the desired locality, the forceps is removed The crystals leave the end of the drain and are dispersed over the adjacent tissues By this one maneuver, sulfanilamide is introduced where it is most needed and the site is also drained

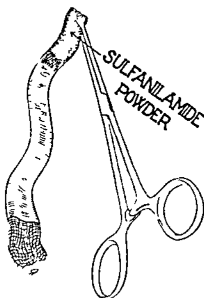


Fig 134 —Cigaret drain with gauze packing pulled back and sulfanilamide crystals in end of drain Sponge forceps holds crystals in place and assists in introducing drain into desired location

(1) J A M A 121 666 Feb 2 1943

ble However, when a patient is seen late and rectal examination shows an abscess in the culdesac, drainage by rectum should be instituted and an interim operation performed, as the mortality rate with this procedure is practically nil In a fulminating case, it is better to remove the appendix and use a McBurney incision with nonclosure of the wound plus rubber tissue drains or a Gibson Mikulicz tampon which should be removed from the second to the fourth day Drains after this period are of no value, except to drain a limited area If a right rectus incision is used a Gibson Mikulicz tampon is indicated If such a tampon is not available, a rubber glove can be used in a similar manner Much too little attention has been paid to the recognition and treatment of acute appendicitis with peritonitis or abscess by the methods mentioned The mortality rate can be lowered by nonclosure of the wound and the use of rubber drains or a Gibson Mikulicz tampon, besides, there is never any infection, phlegmonous infiltration or sloughing of the tissues unless they have been traumatized There is less postoperative pain convalescence is smoother and the danger of evisceration and hernia is no greater with this method than when the wound has been sutured


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woman, 51, who was operated on because of signs of acute appendicitis The peritoneal cavity was full of blood, the source of the hemorrhage being traced to a hematoma of the wall of the cecum which had ruptured

Search of the literature failed to reveal a similar case The predominant feature was the large circumscribed hemorrhage in the wall Except for inflamed appendix, there were no other signs of infection or spread of infection along the base of the appendix to the cecum There was no evidence of an underlying hemorrhagic diathesis Three possibilities are likely explanations

1 There was no history of a blow on the abdomen or similar violent injury as one would have expected had the hematoma been caused by direct violence Further, owing to mobility of the cecum, a lesser degree of injury, unnoticed by the patient, could scarcely have caused the hemorrhage

2 Embolism or thrombosis of the ileocecal artery could not be demonstrated at operation If infarction was the cause it must have been in the terminal branch of the posterior division of the ileocecal artery However, the acute inflammation of the appendix may have been associated with incomplete torsion of the cecum leading to venous congestion capillary rupture and hematoma formation, the condition of torsion then reducing itself before the abdomen was opened

3 There were no signs of infection involving either cecum or ileum However hemorrhage into the bowel wall may occur in terminal ileitis, and it is possible that the findings in this case might have some bearing on the causal factors involved in that condition Jackman cited instances of intramural hemorrhage in the disease, the terminal ileum was involved and the hemorrhages were invariably small, scattered diffusely in the submucous and interstitial layers of the bowel wall and distributed over a considerable length of gut, their cause and spread apparently taking the lines of least resistance Regional and terminal ileitis may also involve the cecum and

Only 60 cases of *torsion of appendices epiploicae* are reported in the literature and few of these were diagnosed preoperatively These appendixes are pedunculated tabs of fat attached to the colon, covered only with peritoneum and varying greatly in size, shape and number They extend from the cecum to the rectum, usually in two rows related to the anterior and the posterior intestinal tenia The largest are usually found on the sigmoid Their true physiology has never been definitely established Pathologically, they may undergo calcification, intra abdominal torsion, intrahernial torsion with strangulation, intrahernial incarceration and adhesions resulting in intestinal obstruction Torsion with acute inflammation is the most frequent pathologic process The cause of the torsion is still a matter of conjecture S Dale Porter[7] (Grinnell) reports a case

Obese man, 38, had acute pain in the left side of the abdomen and was admitted 12 hours after the attack The abdomen was mildly distended, and there was tenderness over the entire area, with some rigidity in the left lower quadrant Rectal examination revealed tenderness in the left quadrant No masses were found He was treated conservatively for 48 hours, after which the pain became more severe localized rigidity was evident and a mass was felt on the left side midway between the umbilicus and the iliac crest Temperature was 100 6 F pulse 90, respirations 22 and white blood count 14 300

Under pontocaine spinal anesthesia, the abdomen was opened with a left gridiron incision A large purplish mass of fat was lying in apposition to the peritoneum, which was also markedly discolored The mass was adherent to the descending colon, and its pedicle twisted with two complete turns It was removed and the abdomen explored and then closed without drainage Recovery was uneventful

Intramural Intestinal Hemorrhage — D Cromie[3] (Newton Abbot Hosp) describes an unusual case in a

(7) J Iowa M Soc 33 223 224 May 1943
(3) Brit M J 2 480 481 Oct 24 1942

bowel wall Several small thrombosed vessels in the neighborhood of cecum and sigmoid were embedded in adhesions and fresh pus The rest of the large bowel and the entire small bowel and mesentery appeared normal in length and shape There was nothing to suggest that a large portion of the bowel had previously been removed The other organs showed no significant pathology



Fig 135 —Double intestine 6 ft 1 in removed at operation (Loeffler above)

Figure 135 shows 72 in of a viscus organ, the width only 4 cm when opened considerably less than a normal large intestine On microscopic examination all three layers of bowel mucosa muscularture and serosa, were seen This is a case of double large intestine and the first specimen seen of such length Because of the connections with ascending and descending colon this specimen cannot be considered a diverticulum

Harry W Christianson[8] (Minneapolis) discusses the usual measures taken to *relieve colonic obstruction* Recently, he saw three cases for the first time when the patients were almost moribund with large distended abdomens Sigmoidoscopic examination revealed growths in the rectosigmoid or distal sigmoid which completely obstructed the lumen In each case he was able to pass a catheter beyond the mass and the obstruction was relieved by a violent expulsion of gas and feces through the tube The catheter was then fixed in place and frequent warm irrigations and suctions were used to keep the tube open and the bowel cleaned out In two of these cases the Wangensteen suction apparatus had been used without giving any relief and in the other case the

(8) Journal Lancet 63 91 January 194[illegible]

some authorities advocate removal of the latter along with the terminal ileum Preponderance of opinion favors conservative measures The cecum may become so thickened and fibrosed, however, that mechanical obstruction results, making excision necessary Had the serous coat of the bowel not ruptured and no operation been performed in Cromie's case, the hemorrhage might gradually have been absorbed and been replaced by fibrous tissue, the resulting appearance being similar to that of long standing ileitis Although in regional ileitis the appearance suggests a chronic infection and distribution and size of the hemorrhages differ from those seen in this case no causal organisms have been found, and the infective element may be secondary, the primary lesion arising in some such way as in this case through mechanical causes such as incomplete torsion of the bowel and hematoma formation

Louis Loeffler[4] (Decatur) found a case of *double large intestine*

Woman, 24 was admitted with pain in the abdomen of several months' duration and symptoms suggesting mild intestinal obstruction A large mass was felt in the left lower quadrant

At operation a mass of adhesions was found in the left lower region with uterus and adnexae embedded and fixed to the sigmoid A loose piece of tissue was easily pulled out and peeled off the mesentery where it was loosely attached There seemed to be no end to it and pulling disclosed a 2 finger thick tubelike organ 5 6 ft long both ends connected with the large bowel one with the sigmoid the other with the colon somewhat above the cecum There was almost no bleeding in removing this structure

The connection with the sigmoid was severed by removing a portion of the sigmoid with which it was bound together with some adhesions to the uterus and adnexae Soon after operation peritonitis developed and the patient died 14 days later

Autopsy confirmed the general peritonitis and revealed extensive necrosis of cecum and sigmoid regions Both portions were entirely gone so that large empty spaces were seen and the open ends showed multiple perforations in a gangrenous

(4) Illinois M J 82 318 319 October 194

instruct these patients to continue on small doses as a measure to increase the bowel tone after discharge

H Neumann[1] *treated* seven patients with *chronic ulcerative colitis by pneumoperitoneum* Clinical grounds, such as chronicity, diarrhea, pus, mucus blood in stools, intractability, governed the indications for pneumoperitoneum, and little weight was put on bacteriologic findings, as various organisms caused clinically indistinguishable forms

TECHNIC—Any of the usual pneumothorax apparatus may be used, the most suitable needles being fairly thin ones with closed, wedge shaped, not very pointed end and lateral opening, and a diameter of about 1/25 in or less Local anesthesia is not required The best place to puncture is about 1 in to the left of and below the umbilicus After short practice it is not difficult to distinguish, from the resistance to the needle, the layers of the abdominal wall and particularly the piercing of the peritoneum The danger of piercing the bowel seems remote, and with the finer needle there would be no danger if the accident occurred

Before passing air through the needle, it is advisable to test with a stylet whether blood or liquid is present The amount of gas introduced averages 500 cc—oxygen or air being used Reading at the manometer is zero, rising slightly after the filling of each fraction and dropping again quickly, eventually remaining at 2 or 3 cm of water Sometimes slight oscillations corresponding to the respiration are noticeable If the needle has not yet reached the peritoneal cavity the manometric pressure rises rapidly, even after introducing the smallest amount of gas The manometer serves in this sense as a control

Another control is reduction and disappearance of the dull liver sound on percussion During or soon after the filling, the patient usually complains about the sudden appearance of pain in one or both shoulders, this is so regular that it is advisable to tell the patient beforehand about it and to reassure him The effectiveness of the filling can be checked by roentgenograms

Refilling can be done once or twice weekly, when pure oxygen is used, the intervals are three or four days because of more rapid absorption When air is used, the

(1) Brit. M J 1 910 Jan 9 1943

Miller Abbott tube had been inserted but apparently it had not passed through the duodenal cap

In one case the distention had completely disappeared by the following day, and the fluid and electrolyte balance was restored in a few more days, making it comparatively safe to do a colostomy The other two patients refused operation but have been free from obstruction for several months

Many cases of intestinal obstruction due to carcinoma of the rectum, rectosigmoid or distal colon can be relieved quickly by this method The obstruction in many cases is brought on by edema and infection of the growth, which can be greatly reduced by warm irrigations through the catheter The method is applicable only to cases in which the growth is within reach of the sigmoidoscope and care must be taken in passing the catheter so that it will not penetrate the bowel wall, as carcinomatous tissue is extremely fragile

Louise Yeazell and H Glenn Bell[9] (Univ of California) resorted to *resection of the* involved portions of the *colon in six cases of Hirschsprung s disease* in children between the ages of 3½ and 12 All patients recovered and results were satisfactory in five while one who required total colectomy has not done so well Sympathectomy or medical treatment alone or together was unsatisfactory

It is the authors plan in these early cases to *attempt* to control the bowel habit by diet, vitamin B, mecholyl or syntropan and colonic flushes if necessary and if this is not adequate to give a spinal anesthetic in the fluoroscopic room so as to watch the response of the colon If there is no response from the anesthetic and the medical regime is inadequate the involved segments should be resected in two stages

Mecholyl is a useful drug but is toxic and the dosage must be watched carefully It might be advantageous to

(9) Surgery 13 941 950 Jun 1943

been accustomed to eat "beef birds" which were rolled and pinned together with toothpicks The long baking may have softened the wood enough to cause it to lose its resistance That one could swallow such an object portrays the careless mastication habits of the individual However, considering the loss of touch sensation that can occur in a patient with upper and lower dentures, it is not only possible but explanatory

During the past several years, Edward Schnug[5] (Univ of Cincinnati) has encountered six cases of *acute diverticulitis of the cecum* In reviewing the literature, he found only 31 additional cases Because of the marked similarity in the clinical pictures of appendicitis and diverticulitis of the cecum the apparent difficulty in recognizing the condition at the operating table and the lack of standardization in its treatment, he felt that an analytic study of the disease was indicated

Most cases occur in patients under 40 and present a fairly characteristic history which closely simulates that of acute appendicitis One third of the patients have had previous attacks In those who have developed large inflammatory masses, palpation of the cecal wall adjacent to the mass through the opposing wall frequently reveals the mouth of the diverticulum which establishes the diagnosis In many cases the reaction is not so extensive and the acutely inflamed diverticulum is easily recognized However, even in the simple acutely inflamed diverticula there is usually an associated indurated inflammatory reaction in the adjacent cecal wall This makes excision of these lesions difficult and closure of the defect difficult and usually insecure The technical difficulty, together with the definite tendency of the lesions to drain into the bowel and subside suggests that surgical removal by radical procedure or local excision is definitely contraindicated in most cases

Acute diverticulitis of the cecum cannot be differ

(5) Surgery 13 8 289 February 1943

intervals are from six to eight days Because of its calming effect oxygen is preferable for the first fillings in patients with major abdominal discomfort and frequent colics and those with a higher grade of secondary anemia and dyspnea The number of fillings required varies, it may be necessary to continue treatment for three months or more

Of the seven patients only one was treated for more than three months In one case, only two fillings were required In some, a moderate amount of peritoneal effusion developed, this fluid was sooner or later reabsorbed spontaneously In such cases it is advisable to give 10 cc calcium chloride intravenously three times weekly Patients who developed temporary ascites seemed to respond more quickly to treatment

Cecum—One of the strangest *foreign bodies perforating the cecum* was found by Stephen A Zieman[9] (M C U S N R)

The patient was felt to have acute fulminating appendicitis with probable recent rupture of the organ and concomitant peritonitis On entering the peritoneal cavity, serosanguineous fluid welled up into the field The cecum was isolated and delivered followed by an exceptionally long appendix vermiformis The appendix was only slightly injected but the base of the cecum presented a mottling of petechial spots that portended further pathology When the gauze protective hold on the cecum was released a scarified ulcerated lesion on the lateral aspect of the organ was found It was thought that pinching of the bowel possibly produced the lesion On rotating the colon laterally, a black foreign body was seen perforating through the center of a similar ulcerated area The object appeared to be a fishbone and was firmly adherent to the bowel, necessitating removal with a hemostat

Both ulcerated areas were sprinkled with sulfathiazole crystals and purse stringed over with an intestinal stitch The appendix was removed and the abdomen closed in layers after spraying with sulfonamide

The *foreign body* was a *toothpick* about 2 in long and incrustated with fecal deposits The patient had

( ) U S Nav M Bull 41 1103 1105 July 1943

closure of the defect is probably not advisable in most cases Except in cases in which an abscess has developed and drainage is indicated, the abdomen should be closed without an appendectomy and without drainage, and chemotherapy should be used This is particularly true when an open mouth to a diverticulum can be palpated

Colon—Joseph F A Connell[6] (Denver) reports on *perforation of a solitary diverticulum of the transverse colon* Diverticula may occur in any part of the intestinal tract, but from a review of the literature they are rare in the transverse colon

Woman, 35, had pain in the right lower quadrant of the abdomen for 12 hours She had no nausea or vomiting and was not constipated A similar attack a year previously was diagnosed as appendicitis She remained in bed a week and all symptoms disappeared until the present attack She had never been constipated and had no history of digestive disturbance She did not appear particularly ill, temperature was 98 2 F and pulse 86 Abdomen was rounded but not distended Moderate tenderness was elicited over McBurney's point, but there was little rigidity There was no tenderness low in the pelvis or on the left side, and no rebound tenderness Because she was menstruating pelvic examination was not made

Diagnosis was low grade appendicitis and she was advised to go to bed and report any change She reported the following day, with increased pain but no nausea or vomiting Temperature was 99 6 F and pulse 94 White blood count was 13,000 with 78 per cent polymorphonuclear leukocytes There was definitely more tenderness over the right side of the abdomen, with rigidity to right of the umbilicus

Diagnosis was acute appendicitis At laparotomy the appendix and cecum were normal there was no Meckel diverticulum but there were a few enlarged glands scattered throughout the mesentery of the ileum In the upper part of the peritoneal cavity a hard nodular mass the size of a small lemon was encountered The incision was extended and the mass delivered It was in the transverse colon about 8 in distal to the hepatic flexure, involving half the circumference of the bowel and extending into the indurated mesentery There was no abscess or evidence of peritonitis and no glands palpable in the vicinity of the mass No gross evidence of diverticulum was present in the colon The hard and nodular

(6) Rocky Mountain M J 39 435 436 June 1942

entiated clinically from acute appendicitis and, as a result, must occasionally be coped with when operating for the latter The diverticula of the cecum are characteristically solitary and of the true type (Fig 136) When acutely inflamed, they show varying degrees of reaction, from a simple acutely inflamed cecal outpouching to the development of a large indurated inflam

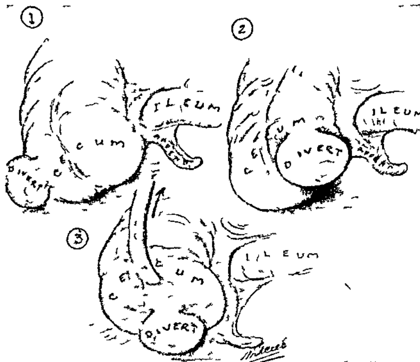


Fig 136—Three most common locations of solitary diverticula of cecum

matory cecal and pericecal mass The disorder should be considered in any patient with acute symptoms and signs *referable to the right lower quadrant* who previously has had an appendectomy If a clinical diagnosis can be made, conservative treatment along with chemotherapy should be instituted

Radical excision of the mass by resection and anastomosis is definitely not indicated and local excision with

Benign Tumors of Large Intestine —Elson B Helwig[7] (Washington Univ) bases his report on 1,460 consecutive autopsies in which the entire large intestine was available for study Each intestine was carefully examined in the fresh state, all grossly discernible elevations and irregularities of the mucosa were removed and fixed The exact diagnosis of the lesion was established on the basis of the microscopic structure Although all carcinomas and sarcomas were excluded from this study, a small number of adenomas showing microscopic foci of carcinoma were included Helwig found 139 adenomas,



Fig 138 (left) —Adenoma of sessile type Reduced from × 3 6
Fig 139 (right) —Adenoma of pedunculated type stalk covered by normal mucosa Reduced from ×

13 lipomas, 1 carcinoid and 1 leiomyoma, a total of 154 tumors

INCIDENCE OF ADENOMAS IN COLON AND RECTUM

	Adenomas Solely in One Site		Adenomas in Both Sites		Total	
	Cases	%	Cases	%	Cases	%
Colon	103	7 05	17	1 15	120	8.22
Rectum	18	1 26	17	1 15	35	2.39

(7) Surg Gynec & Obst. 76 419 426 April 1943

character of the tumor led to diagnosis of carcinoma and resection was deemed advisable This was done, keeping well outside of the mass, and an end to end anastomosis was performed She made uneventful recovery and is in excellent health

The specimen included a portion of the large intestine Near the center of the resected area was an eccentric pouch communicating with the lumen of the bowel and projecting considerably beyond the serous surface of the intestinal wall forming a pocket 1 cm in diameter near the serous coat Through a perforated opening in the serosa, the



Fig 137 —Section of transverse colon showing diverticulum and ulcer

diverticulum communicated with the free peritoneal cavity The intestinal wall in the region of the perforation revealed interruption in continuity of the muscle fibers The entire ulcer area was mottled with necrotic foci densely infiltrated with polymorphonuclear leukocytes and with large interstitial ecchymoses On either side, the mucous membrane lining was well developed and intact Abrupt interruption of continuity of the muscular structure and density of the acute inflammatory exudate suggested an acute nonspecific ulcerative process in a diverticulum No evidence of malignancy or any signs of specificity were noted Figure 137 shows the abrupt interruption of the muscle layer, also the well developed mucous membrane producing the diverticulum

The incidence of adenoma was 9 5 per cent With omission of one case of familial polyposis, the remaining 138 cases represented 272 adenomas Single adenomas were present in 80 cases and two or more adenomas in 59 The table shows the incidence of adenomas in the colon and rectum

In this series the incidence of adenomas in the colon was appreciably greater than that reported by others The sigmoid colon is the most common site in the large intestine The tumors may be either sessile (Fig 138) or pedunculated (Fig 139) A few were only 1 mm in diameter, and the largest measured 9 cm in its greatest diameter

The incidence of lipomas was 0 89 per cent and is also greater than that reported by others In 10 cases there was a solitary lipoma and in 3 two or more lipomas The cecum and the contiguous ascending colon were the most common sites The submucosa was involved in 12 cases In three of these the tumor was of the single pedunculated type (Fig 140) and in nine it was sessile (Fig 141)



Fig 143 —Carcinoid of rectum note intact layer of mucosa Reduced from × 9 8

The leiomyoma was located in the sigmoid colon of a man, 67, and formed a pedunculated firm mass measuring 11 mm in its greatest diameter (Fig 142)

The carcinoid was located in the rectum of a man, 56 Grossly, it formed a firm hemispherical elevation measuring 15 mm in its greatest diameter and projecting into the lumen of the intestine (Fig 143) A smooth but

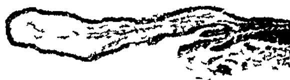


Fig 140 —Lipoma of pedunculated type ×2 5



Fig 141 —Lipoma of sessile type Reduc d from ×4 6

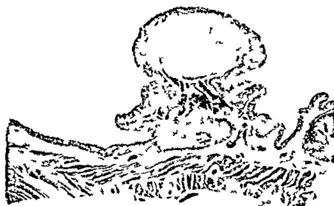


Fig 142 —Leiomyoma of pedunculated type tumor is separated from muscularis by stalk of connecti e tissue. Reduced from ×3 6

the bars formed between the openings prevent loss of the excised specimen The instrument is sturdily built and is manufactured in different working lengths, the one illustrated is 40 cm. long

Complications and Causes of Mortality of Surgery for Carcinoma of Colon and Rectum —John H Garlock, Leon Ginzburg and Ameil Glass[9] review the cases seen at Mount Sinai Hospital, New York City, from July, 1937, to July, 1941

Many patients admitted to the wards present com

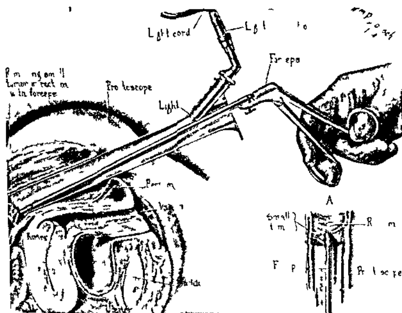


Fig 145 —Sagittal section showing removal of a small sessile polyp with forceps *A* angle of jaws of forceps as viewed from above (Turell p 446)

plicating medical conditions which influence morbidity and mortality of major surgical procedures It is important therefore, to extend the preoperative period of rehabilitation in patients with colonic cancer to minimize effects of these complications

Operability was influenced more by conditions associated with the growth itself than by age, obesity,

(9) Surg Gynec & Obst 6 51 59 January 194

otherwise normal appearing mucosa covered the nodule which moved freely with the submucosa

Robert Turell[8] (New York City) presents a *new recto sigmoidal biopsy forceps* (Fig. 144) embodying several new features

INSTRUMENT —The shaft with the cutting jaws at its distal end has a rotating mechanism with a locking device near the handle, permitting 360 degree rotation of the jaws, so that the latter will face directly a suspected lesion anywhere in the circumference of the rectum or sigmoid (Fig 145) Furthermore, the cutting jaw mechanism operates at an angle of about 30 degrees from the axis of the shaft and consists of a stationary and a moving jaw, the latter opening and closing side

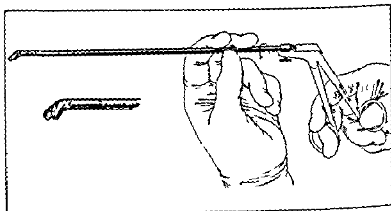


Fig 144 —Biopsy forceps and view of rotary movement of the shaft.

wise (Fig 145A) which permits better visualization of the tissue engaged in the cutting jaws until they are closed (Fig 146) especially in the case of small polypoid lesions Thus with this forceps mucosal excrescences and small sessile or pedunculated adenomas can be removed for microscopic study with ease and safety prior to fulguration

The forceps has scissor handles to apply positive pressure for opening and closing the jaws The moving jaw fits inside the cutting edge of the stationary one, thus assuring a clean cut specimen by the shearing action of the jaws no overhanging lips interfere with the clean excision of tissue The jaw capacity is ample and the stationary jaw has two openings to prevent crushing and distortion of the specimen Also,

(8) Ann Surg 110 63 (39 October 194

peritonitis than use locally at operation Postoperative pulmonary complications were most influenced by the sulfonamides

Cardiovascular complications were the major cause of postoperative morbidity and mortality

Wound disruption has been eliminated by use of buried alloy steel wire A rarely mentioned postoperative complication following colonic surgery is retraction within the abdomen of a loop of bowel

For carcinomas of the right colon the authors favor two stage ileocolic resection, with a three or four week interval between operative procedures There was no operative mortality in this group They favor obstructive resection with excision of a wide section of mesentery for neoplasm of the transverse and left colon Mortality in this group was 3 5 per cent Suture anastomosis of the left colon should not be carried out unless there has been a preceding complete diversion of the fecal current

For small carcinomas of the rectosigmoid the authors favor the Devine operation, consisting of transection of the transverse colon and resection of the tumor bearing portion of bowel with suture anastomosis For carcinoma of the rectum, they prefer in most instances one stage Miles abdominoperineal resection For low lying neoplasms in elderly individuals, the Lockhart Mummery procedure has real value

The fact that 20 25 per cent of the patients with carcinomas of the rectum had undergone treatment for hemorrhoids during the preceding two to five months emphasizes the importance of careful digital rectal examination followed by proctoscopic visualization in all patients who complain of bleeding from the rectum

Application of a crushing clamp to a *colostomy spur*, perhaps the simplest operation which the surgeon is called on to perform, is carried out with such frequency, such ease and so little discomfort to the patient that thought is rarely given to the possibility of untoward

anemia, etc Free perforation of carcinoma of the colon resulted in death in almost all instances

Use of the Miller Abbott tube pre and postoperative

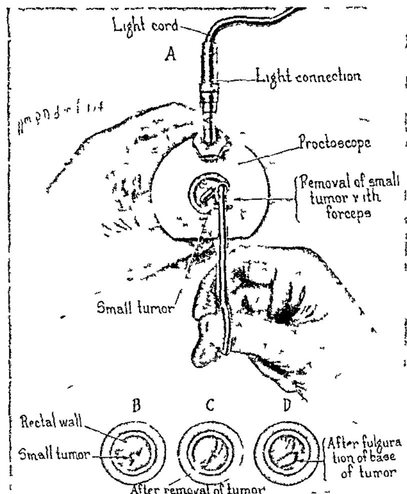


Fig 146 —*A* actual view of tumor n relation to jaws of forceps *B* tumor in situ *C* appearance of ba e of t mor after removal *D* appearance of base of tumor after coagulation. (Turell p 446)

ly is particularly emphasized Preoperative oral ad ministration of sulfanilamide was a greater factor in de creasing incidence of postoperative wound infections and

(7) hemorrhage, packing, recovery In addition to these, the authors have seen patients die, after application of clamps, of such varied causes as bronchopneumonia, pyelonephritis, septicemia and general peritonitis In these cases it would be difficult to determine how important a contributory role was played by the operation Most of the patients were thought to be in satisfactory condition at the time clamps were applied or the procedure would not have been carried out Necropsy revealed no direct relationship between death and clamping, i e, whether patients would have survived had operation not been performed cannot be determined

Louis Berger[2] (Brooklyn) describes a new *instrument for crushing the spur of a colostomy* The greatest objection to most clamps is that once the clamp is applied and pressure exerted on the septum of tissue the tips tend to rotate, they spread apart rather than crush the tissue evenly When the clamp is removed, a stump or stub of septum is left which requires reapplication of the clamp

Consideration of the mechanics shows that all clamps are essentially two rigid bars whose faces are drawn against tissue The bars act as levers in that their fulcrum is somewhere along the length of tissue being crushed while the force is remotely applied at some external point, such as the screw drawing the two bars together Manifestly, the bars rotate about this fulcrum point in the tissue causing the tips to diverge Of course the longer the bars and the more remote the screw drawing them together, the greater the rotation at the tip of the clamps In Berger's instrument the tendency to rotate is counteracted by providing another positive fixed external fulcrum, adjustable for any desired angle of rotation by the fulcrum screw about which it must rotate The screw threads into one part of the clamp and its point fits into a drilled socket in the other

(2) Am. J Surg 58 15 154 Oct ber 194

complications Charles W Mayo and Carl P Schlicke[1] (Mayo Clinic) recall that serious and sometimes fatal complications may follow The complications may manifest themselves shortly after application of the enterotome, at any time while it is in position, or not until a variable time after its removal Occurrence can be kept at a minimum by care in formation of spur at time of operation, by care in application of the crushing device and by proper management of the patient during convalescence Afferent and efferent limbs must be carefully approximated to prevent interposition of important viscera which *might be injured in crushing the spur* The limbs should be rotated so that the mesenteric blood supply will not be occluded by the enterotome and no unnecessary pain will be caused by inclusion of mesentery between the blades Formation of a long spur facilitates closure because a large, direct communication between proximal and distal limbs can be established readily, re establishing normal intestinal continuity

The clamp should be protected while it is in place, and activity of the patient should be limited Confinement to bed is unnecessary but reasonable surveillance is essential Hasty tightening or premature removal of the enterotome is to be avoided The surgeon should bear in mind the complications which may occur whenever unusual reactions follow application of clamps or whenever he finds himself regarding the procedure as trivial or performing it thoughtlessly or hastily

Complications seen by the authors and their results include (1) acute perforation of bowel general peritonitis death (2) injury to jejunum jejunocolic fistula, malnutrition death (3) injury to ileum, ileocolic fistula, operation recovery (4) injury to ileum, ileocolic fistula, conservative management recovery, (5) injury to ureter, ureterosigmoidal fistula, conservative management recovery (6) hemorrhage transfusion, recovery,

(1) Am J Surg 58 9 34 October 1942

wrench to facilitate tightening and loosening the lock nut and fulcrum screw which is shown at *E*

In crushing the septum, the left jaw clamp is inserted into the lower loop of the double barrel colostomy and the right jaw into the upper lumen to the depth desired The two jaws are brought together with the guide pin The clamp bolt is then inserted so that its head is held snugly in the recess of the left jaw and the lock nut is threaded on, holding the hand tightly so that the clamp jaws grip the septum firmly The

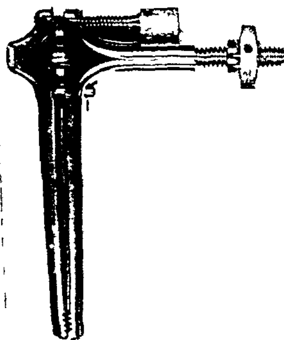


Fig 148 —Instrument assembled.

fulcrum screw is tightened by the pin wrench, giving the clamp tips the desired amount of advance The pin wrench is applied to the lock nut and tightened until it jams against the cylinder barrel of the right jaw Both jaws jammed in place will prevent slipping from the position and pressure selected Usual care must be exercised not to apply excessive pressure

The next crushing adjustment is made by releasing the fulcrum screw about one-half turn with the pin wrench and then immediately taking up the play until the desired additional crushing has been effected for the second stage the fulcrum

half, tending to force the external ends of the clamp apart This causes the clamp tips to rotate toward the tissue This is especially the case in that area which usually results in a stub or a stump

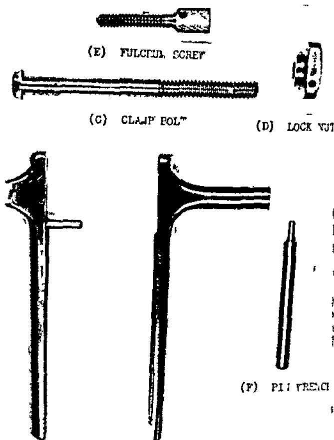


Fig 147 —Various parts of instrument for crushing the spur of a colostomy

INSTRUMENT —This consists of (Fig 147*A*) a left clamp jaw 4 in long over all, bearing a guide pin on its crushing face, (*B*) a clamp jaw bearing integral with it and at right angles a cylinder to receive the bolt, (*C*) a clamp bolt used in conjunction with the lock nut (*D*) a lock (*F*) a pin

of the ascending colon rarely occurs without occult blood in the stool, and it is usually possible to diagnose carcinoma at this level by careful and repeated fluoroscopic examinations and lateral roentgenograms, which are of value in revealing posterior wall lesions

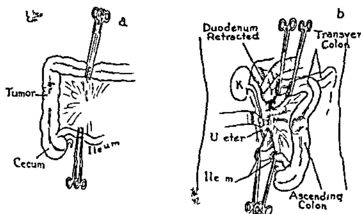


Fig 149 —*a* Amount of ileum ascending colon and transverse colon to be resected dotted lines indicating radical extent of removal of attached mesentery and glands In *b* lateral parietal peritoneum has been incised colon turned inward ileum and transverse colon divided between clamps and mesentery severed up to its root Duodenum has been separated from root of mesentery and held up and ureter has been retracted out thus permitting extensive removal of mesenteric root to the midline

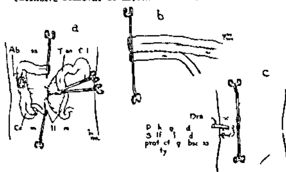


Fig 150 —*a* Method of dealing with carcinoma of ascending colon with abscess Transverse colon has been severed between clamps as has ileum but abscess is not opened and ascending colon removed until mesenteric root of the Mikulicz resection has been sutured thus segregating the general peritoneal cavity With gauze packs around the bowel segregated section of colon with abscess can be dealt with abscess sucked out and carcinoma-containing colon removed *b* Long approximation of ileum to transverse colon to make a long spur to cut In *c* segregated section of bowel containing carcinoma with abscess shown in *a* has been removed abscess cavity dried out filled with sulfanilamide and packed with gauze and end of drain is shown emerging through a counterincision.

screw and lock nut are jammed as above Subsequent stages are but repetitions of the foregoing processes

The instrument has many advantages It is light and protrudes only 1 in above the abdomen Application is easy for the patient, for its jaws are completely separate, and the few parts are reassembled without difficulty Daily adjustments during the crushing process are easy and crushing of the septum is even throughout the length of the clamp surface, leaving no stump to be eliminated later

From their experience in 170 *resections of the right colon* and terminal ileum, of which 112 were for carcinoma, 53 for regional ileitis, 4 for tuberculosis and 1 for endometriosis, Frank H Lahey and Eric Sanderson[3] (Boston) have drawn conclusions largely related to the first two conditions

In diagnosis of carcinoma of the right colon they were impressed by the presence of severe grades of secondary anemia in 70 per cent of cases while the lesion was still removable No one has ever explained why a relatively small lesion of the ascending colon can produce such severe grades of secondary anemia From the aspect of possible early diagnosis it is unfortunate that an ulcerating lesion in the right colon, until fairly well advanced and involving other structures, causes so few symptoms and such little inconvenience and that the caliber and size of the cecum and ascending colon are such that lesions particularly on the posterior wall, may fail to show in the barium filled cecum and are easily overlooked by the roentgenologist As to physical history, malignant lesions at this level present the same features as those at other levels in the colon appearance of blood, gross or microscopic and mucus, change in bowel habits anemia, loss of weight and vague abdominal symptoms These lesions also tend to be less palpable through the abdominal wall than those of the sigmoid rectosigmoid and rectum However carcinoma

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of the ascending colon rarely occurs without occult blood in the stool, and it is usually possible to diagnose carcinoma at this level by careful and repeated fluoroscopic examinations and lateral roentgenograms, which are of value in revealing posterior wall lesions

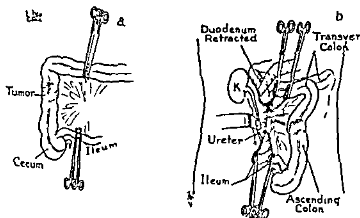


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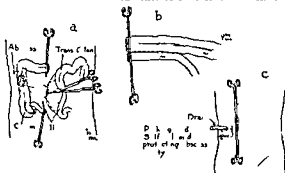


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Many cases have been regarded as inoperable and the wound has been closed when the involvement of other structures was only contact extension and not true metastases The authors repeatedly found it possible in cases with contact metastases to do multiple level resections In several such cases, the lymph nodes of both structures were uninvolved and there was no recurrence for several years After using the modified Mikulicz operation for several years, they are convinced that—after the right colon has been mobilized (by incising the lateral leaf of peritoneum outside the colon)

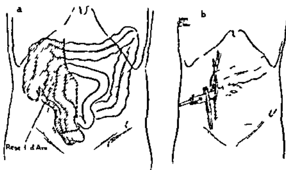


Fig 151 —*a* Amount of ileum ascending colon hepatic flexure and transverse colon (shaded area) and extent of mesenteric apron with its glands which can be removed radically in either carcinoma or regional ileitis *b* Devascularized segment of ileum for decompressing ileum and rubber clamp placed on it while catheter or rubber tube is sutured in end to be conducted to a bottle at side of bed for immediate decompression

and turned inward—it is important to find at once, behind the rotated colon, the ovarian vessels in the female or the spermatic vessels in the male, and then the ureter The ureter should be mobilized throughout its entire extent so that a large leaf of mesentery, running from the terminal ileum up to the apex of the V of right mesentery which is to be removed, can be freed The retrocolic duodenum is then dissected from the root of the mesentery since only by completely freeing the hepatic flexure turning it inward and completely freeing the retroperitoneal duodenum will it be possible to extend removal of the mesentery of the right colon

sufficiently close to its root in the midline to remove adequately all its contained nodes (Fig 149 b)

In resections of the terminal ileum or of the right colon, it is desirable to include all the ascending colon, hepatic flexure and right portion of the transverse colon, because this permits wider resection of the mesentery of the right colon and of the hepatic flexure (Fig 149 a) with its lymph nodes and because the ileum can be applied more satisfactorily to the transverse colon



Fig 15[illegible] —Regional ileitis showing extension to ileocecal valve infiltration of all coats and stricture near ileocecal valve

than to the angulated often reduplicated, hepatic flexure This makes a much better and accurately opposed Mikulicz double barreled tube One of the important things is to be sure that a much longer loop of ileum is tacked (Fig 150 b) to the transverse colon than is thought necessary it is no disadvantage to tack too much, but it is a considerable disadvantage to tack too little If the amount of transverse colon that can be pulled up into the wound is insufficient, this can be remedied by freeing the gastrocolic omentum to the left transverse colon, liberating the attachment of the splenic flexure, lowering it and making available longer loops of transverse colon

Occasionally, a carcinoma has perforated and is surrounded by an abscess It is possible with a modification of the Mikulicz procedure (Fig 150 *a*) to deal with this safely and satisfactorily The transverse colon and ileum are cut between clamps and the mesentery is severed, but the adherent ascending colon with the carcinoma and abscess about it is not removed The root of the mesentery is carefully sutured, thus excluding the small intestine and serving as a coffer dam With gauze packs about the segregated section of ascending colon containing the carcinoma and abscess, walling off the rest of the abdomen, the abscess can be entered, sucked out and drained the colon removed and the abscess cavity thoroughly dried out filled with sulfanilamide and packed with gauze The gauze surrounded on its external portion by rubber dam can then be brought out through a counterincision (Fig 150 *c*) and the Mikulicz loop implanted in the wound

The desirability of having a long loop of ileum attached to the transverse colon derives from the necessity of cutting down for a long distance the spur or septum in the double barreled Mikulicz loop to restore the fecal stream and insure an adequate pathway for it through the Mikulicz region

This modified Mikulicz type of procedure has given satisfactory results With it by staggering of the devascularized terminal loop of ileum (Fig 151 *b*), it is possible to insert a catheter or a Paul tube into the end of the ileum at the time of operation connect it by a rubber tube to a bottle beside the bed and accomplish immediate decompression of the small intestine There is nothing more important in any intestinal resection than ability to decompress at the time resection is done Patients sometimes die following colon resections not because of the resection itself necessarily but as the result of temporary obstruction and the effect of this on the general condition and the suture line The devascularized loop of ileum into which the tube is inserted will slough

off even with the abdominal wall, resulting in a double barreled intestinal loop the ends of which are at the same level on the abdominal wall (See Figure 151 *b*)



Fig 153 —Typical string sign of Crohn in regional ileitis note extension of process onto colon

The clamp on the spur of the Mikulicz loop is applied the sixth to seventh day, and it is better to apply it two or three times than to attempt to cut the septum of the spur with one long clamp the hazard of perforation

with such a clamp is considerably greater than it is when two or three small bites are taken

Five year follow up showed that 43 per cent with carcinoma of the rectum and 57 per cent with carcinoma of the colon, in whom the radical operation was performed, remained well without recurrence The nonrecurrence rate in carcinomas of the right colon averaged the same rate as carcinomas of the colon at other levels

Regional or terminal ileitis is an inflammatory reaction to an agent not microscopically demonstrable

Diagnosis has been based on history of right lower quadrant pain, often diarrhea and intermittent obstruction, chronicity of the history, weight loss and often a previous operation such as appendectomy, without relief Palpable masses have occasionally been present and external and internal fistulas have been demonstrable in 25 per cent of the cases In many cases, it has been possible to demonstrate the rigid ileum (Fig 152) and in many others the typical "string sign" of Burrill Crohn (Fig 153)

No medical measures offer any prospect of limiting its extension Radical resection of the ileum, ascending colon and hepatic flexure is necessary because it removes effectively the infected segment of bowel and with it the infected lymph nodes in its attached mesentery In 53 resections, the authors have had only 1 death (case of abscess and perforation) Two growths recurred in the remaining ileum in the beginning of the series when removal of the ileum was done with limited resection of the ascending colon thus leaving infected lymph nodes in the remaining areas of attached mesentery Since then it was realized that the infecting process not infrequently extends over onto the ascending colon for varying distances and that wider resection is necessary Thus, the same plan of resection has been consistently applied in regional ileitis as in carcinoma of the right colon

In regional ileitis there is a stage with red acutely

inflamed ileum, covered with fibrin, in which it is preferable not to resect, at this stage, the peritoneum has not yet vaccinated itself well to the infection, the inflammatory reaction in the mesenteric lymph nodes is acute and

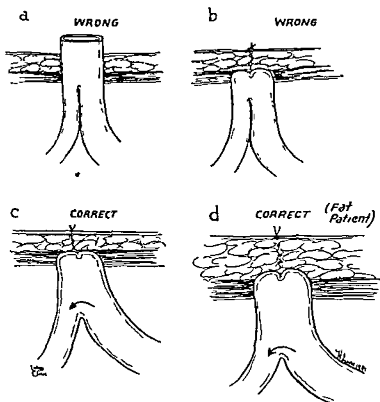


Fig 164 —*a* Inadequate cutting of septum in spur *b* When end of Mikulic enterostomy is closed and inverted and septum inadequately cut feces are thrown up against the closed end to threaten reopening and aperture for passage of fecal stream is inadequate *c* Spur has been well cut down note adequate aperture for passage of feces when end of the Mikulicz enterostomy has been closed at second stage *d* This spur has been closed beneath level of fascia contrary to closure above level of fascia beneath skin and fat *d* is similar to *c* showing adequate cutting of spur with adequate aperture for fecal stream but in an obese patient the end of the Mikulicz enterostomy can be closed above the layer of the fascia being covered only by subcutaneous fat and skin

makes them more difficult to handle Often at this stage the patient has been operated on elsewhere under the mistaken diagnosis of acute appendicitis (25 per cent in this series) This has allowed self vaccination of the

peritoneal cavity to the lesion and the lesion to become more chronic It is always necessary to investigate other levels of small intestine to make sure that other segmentally involved areas do not exist

Certain points particularly related to successful second stage closure of the Mikulicz enterostomy after the spur has been cut require further discussion It is wise not to attempt closure earlier than two months after the operation Before this, the wound is often edematous, there are small fluid pockets of undigested catgut in it and the peritoneum has not become firmly fixed to the neck of the intestinal spur After two months, no matter how much skin reaction there is, closure is safe since this reaction is largely of chemical or digestive nature and will disappear as soon as the ileocolostomy is closed Wound infection is rare even when closure is done in presence of this skin irritation, there have been only three mild infections in all these resections

When a patient returns for closure, it is necessary to investigate how low the spur has been cut at the first operation The septum may still be too high (Fig 154 *a* and *b*) and may need further cutting down by deep application of clamps (Fig 154 *c* and *d*) A segment of uncut septum left when the external Mikulicz has been closed will throw the feces up against the closed end of bowel and threaten establishment of a fistula (Fig 154 *b*) An important point when the tube of bowel is prepared for closure at the second operation is that all indurated tabs of epiploic appendixes or attached mesentery be freed from the bowel The bowel must be dissected from the skin, the attached cuff of skin cut away and the bowel so freed from subcutaneous fat and indurated fat pads of mesentery that when it is inverted by the in out and over stitch, it will bury and invert itself as accurately as will a segment of free bowel in the abdominal cavity Otherwise, it is likely to reopen after 7 to 10 days because it has been forced inward despite indurated pads of fat and as soon as the catgut ab

sorbed, the mucosa everts and a mucus lined, external fistula is again established When freeing the external tube of bowel, it should be left attached only to the peritoneum and be inverted below the level of fascia (Fig 154 c) However, in patients with fat abdomens it is frequently satisfactory to separate the bowel down to the fascia, bury it at the level of the fascia and close the skin and subcutaneous fat over it (Fig 154 d)

A small strip of rubber dam is left to emerge at the upper and lower angles of the wound (Fig 155) and is withdrawn the fifth or sixth day In no case has there been serious wound infection In a few cases temporary fistulas resulted, but it is rare in secondary closure for the wound not to heal by first intention

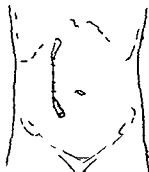


Fig 155 —Rubber dam brought out through upper and lower ends of wound after Mikulicz enterostomy has been closed

There have been 19 deaths in the series of carcinoma of the colon and 1 in the resections for regional ileitis (most of which occurred in complicated resections), a mortality of 11 7 per cent

The modified Mikulicz type of operation allows resection on patients with moderate degrees of obstruction in whom preliminary decompressions would otherwise be done and it has eliminated largely the fear of leakage and development of peritonitis

Rectum—Dissatisfied with the tedious and often futile treatment along accepted lines Laurence G Bodkin[4] (Brooklyn) evolved a new surgical procedure to deal with *stricture of the rectum* Careful attention to the patient's own description of his difficulty gives a valuable clue The history always contains one significant statement "There was great straining with little result, then the stool finally passed when the straining let up"

(4) Am J Surg 61 77 79 August 1943

The stool at this time was liquid or semisolid and should have been able to pass through the constricted lumen This suggested that it may not have been the small lumen that resisted the passage of the stool It was more likely the prolapse of the rectal wall into the narrow stricture, plugging and closing it during the period of straining Inflamed edematous mucous membrane would be especially susceptible to this action Fixation of the rectum above the stricture was decided on as the remedy

PROCEDURE —An incision is made in the skin between the rectum and the coccyx and deepened, passing through the anococcygeal ligament into the posterior rectal space The finger is inserted and bluntly dissects the rectum from its surrounding structures as far as the finger can reach The outermost aspect of the stricture can be palpated, even visualized, and the rectal wall can be freed well above this point The only upward limitation is that made by the peritoneum The finger does not readily reach this and is not likely to penetrate it even if in contact with it

Three strips of gauze are inserted, one on each side and one posterior to the rectum These create local irritations which result in the formation of a broad bed of scar tissue, surrounding the rectum on three sides at least and preventing its downward propulsion *The gauze strips are removed one at a time*, each day after operation The wound drains pus for three or four weeks and gradually clears up, leaving behind it the desirable bed of scar tissue

Postoperative dilatation is not recommended It apparently adds to local irritation It is far better to permit the stool, now descending more freely, to dilate the stricture Two cases are reported, both patients were treated successfully

Howard Robert Seidenstein[5] (New Rochelle, N Y) finds that *rectal stricture due to lymphogranuloma venereum* is best treated by prolonged local and general sulfonamide therapy combined with at least one course of Frei antigen intravenously The first part of the treatment can be given by retention enemas of azosulfanilamide It would seem that each part of the treatment is

(5) Surgery 14 73 82 July 1943

responsible for about 50 per cent of improvement

Results in five similarly treated patients ranged from good to poor, although every patient improved to some extent One patient had a complete cure subjectively and objectively for 21 months and then showed a recurrence of proctitis in a former area of inflammation although the cured stricture previously present in another area did not return A second patient was symptomatically cured with objective improvement so marked that an excellent surgeon has attempted surgical cure of her rectovaginal fistula The three others at least have shown no progression of their disease for over a year, are symptomatically cured and objectively somewhat improved

A rise in temperature following injection of mouse brain Frei antigen intravenously is not a reliable test of the presence of lymphogranuloma venereum The Frei test does not seem to be reversed after treatment, despite clinical improvement and arrest of the pathologic process Serum globulins appear to be increased No explanation can be offered for the complete disappearance of a stricture under the regimen described Despite complete local arrest, there is evidence of continued action of the virus This conclusion may be of interest from a public health standpoint

Prolapse of Rectum —Isidore Cohn[4] (New Orleans) suggests the following procedure which he used in a case of 11 years' standing

TECHNIC—The lower bowel was thoroughly cleansed prior to operation Under spinal anesthesia, with the patient in the lithotomy position, the prolapse was completely extruded A gauze strip was introduced through the bowel lumen as high as possible to avoid contamination of the field On either side of the orifice of the bowel, an Allis forcep was applied to give better fixation during operation An incision was made in the long axis of the mucous membrane of the prolapsed bowel and extended up to within ½ in of the mucocutaneous margin (Fig 156) Mucosa was retracted to expose the vessels and muscularis of the everted loop Vessels were clamped

(4) Am J Surg 444 449 Sept ml 194

ligated and sectioned Mucosa was separated from the muscularis circumferentially An incision was made in the muscularis exposing the peritoneal pouch in the prolonged Doug

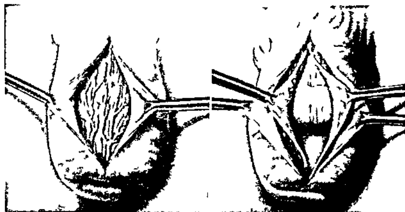


Fig 156 (left) —Incision in long axis of mucous membrane of the prolapsed bowel to within ¼ in of mucocutaneous margin
Fig 157 (right) —Incision through muscularis peritoneal pouch in Douglas culdesac is seen

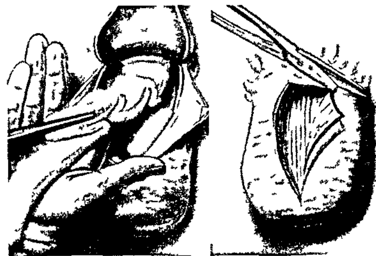


Fig 158 (left) —Pack to hold herniated bowel and peritoneal reflection up during further stages of operation
Fig 159 (right) —Section of muscularis and outer coat of everted loop

las culdesac (Fig 157) The peritoneal pouch was separated from the rectum and bladder by dry dissection Peritoneum was opened and bowel packed off (Fig 158) Muscularis and outer coat of the everted loop were sectioned near the muco

cutaneous border just above what should be the sphincter (Fig 159) This left the elongated barrel of the prolapsed bowel ready for section or for use for traction purposes Peritoneal opening was closed and a strip of gauze introduced to pack off the peritoneal pouch Gelpi retractors were installed for exposure

Sutures were introduced on either side into the levators and a bite of the outer surface of the rectal wall was included in the sutures (Fig 160) When the sutures in the levator had been introduced, they were tied one by one to fix the rectum

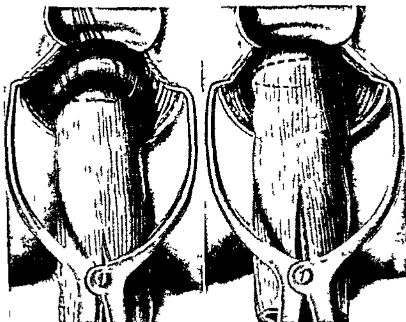


Fig 160 (left) —Sutures in each side through levators to form a buffer
Fig 161 (right) —Point of sections of the prolapsed loop

at the highest point and repair the pelvic floor The next step was to section the proximal portion of the extruded loop (Fig 161) A continuous suture or multiple sutures were used to approximate the cut end near the mucocutaneous junction and the cut end of the proximal loop (Fig 162) No pack was introduced into the orifice at the conclusion of the operation It was not thought necessary to plicate the sphincter

Because no report of *primary lymphoid tumor of the rectum resembling internal hemorrhoids* could be found in the literature, Tom E Smith[6] (Baylor Univ) presents

(6) J A M A 1 1 495 498 Feb 13 1943

three cases one of lymphosarcoma and two of lymphoma All were clinically diagnosed as hemorrhoids because there were no other changes visible or palpable to suggest any other lesion Induration to palpation was present but the zones were freely movable by the examining finger, endoscopy revealed the maroonish purple look of internal hemorrhoids and in fact, hemorrhoids were present as proved by microscopic examination



Fig 162—Suturing distal end of bowel to skin circumferentially (Cohn p 465)

The primary purpose of reporting these cases was to make an appeal for histopathologic examination of all excised anorectal tissue since these cases were diagnosed correctly from tissue study when the clinical preoperative diagnosis did not allow for the lymphoid changes present

Correct tissue diagnosis of lymphosarcoma in Case 1 led to early roentgen therapy and will deserve credit for the patient's life if she has no recurrence

In the other two cases, correct tissue diagnosis of lymphoma has put everybody on guard and check up examinations will be made at regular intervals with use of roentgen therapy immediately should either or both show lymphoid tissue regeneration

Tumors of the rectum comprise a large and varied group Kenneth E Smiley[5] (Los Angeles) limits discussion to the polyps or polypoid tumors especially those of questionable or frank malignancy With rare exceptions these consist of benign and malignant ade

(5) California & West M d 5 310-13 November 194?

nomas, villous papillomas and carcinomas resembling sessile adenomas or, more rarely, papillomas The adenomas are true mucosal tumors and vary in size from tiny, flat, almost invisible growths to tumors several centimeters in diameter When small, they are sessile, but as they enlarge a pedicle of normal mucosa may or may not be formed by the constant tug of the bowel wall Histologically they resemble normal mucosa, except that the glandular structures are more elongated and variable in size Villous papillomas are soft and spongelike in appearance and on palpation, usually have a wide base and may fill the rectal ampulla

It is believed that many if not all rectal polyps are definitely premalignant, although high grade malignancies are rarely found arising in polyps Often low grade carcinoma may be found in the most innocent appearing polyps It is significant that some polyps in multiple polyposis almost invariably become malignant and are indistinguishable from the ordinary solitary adenoma Further support for the belief that the adenoma is pre malignant is found in the age incidence, average age of patients with polyps is about 10 years less than that of patients with carcinoma Also, comparative figures for location of the lesions show great similarity Therefore greater efforts should be made to establish early diagnosis

There are no diagnostic symptoms of any one rectal tumor When the polyp is small or even of considerable size, symptoms referable to the anorectal region may be absent and the tumor noted on routine proctoscopic examination Villous papillomas may almost fill the rectum, yet produce few symptoms Bleeding the most frequent symptom, may occur before, with or after the stool and be mixed with mucus A change in bowel habits is especially significant In some, tenesmus and passage of frequent small stools is present and in others constipation from obstruction by a large polypoid mass

Dull aching pain, pain in the back, a feeling of fulness in the rectum or discomfort of a protruding tumor are not infrequent

Diagnosis is based on physical examination and laboratory studies Careful digital examination should be followed by visualization of the well prepared bowel Ulceration, induration or fixation suggests malignancy Sessile types of tumors have not appeared to be more frequently malignant than the pedunculated variety Material for biopsy may be removed without danger However, biopsy is not entirely reliable because only a small piece can be removed and may not be obtained from the proper location to show early malignancy Study of the entire tumor is of greater importance Roentgen study, especially by air contrast technic, is advisable with symptoms suggesting tumor but negative instrumental examination or to determine presence of other polyps However, the lower few inches of the large bowel are difficult to examine satisfactorily with roentgen rays, and instrumental examination should precede roentgen study Errors are chiefly those of omission

Type of treatment rests largely on clinical diagnosis If the lesion seems benign, a sessile tumor should be destroyed by fulguration or cautery and a pedunculated tumor removed by ligation of the pedicle or preferably with the fulgurating snare With the large, low lying villous papilloma it may be simpler to excise the entire tumor with cautery removing it with its base rather than attempt destruction by fulguration

Two dangers are ever present perforation and bleeding Below the peritoneal reflection destruction of the entire thickness of the bowel wall is ordinarily of little consequence, but above the reflection it is possible to perforate the wall at time of operation or subsequently by sloughing of tissue Should this occur the abdomen must be opened immediately and the defect repaired With chemotherapy this is fairly safe

Hemorrhage is ordinarily not difficult to control, but may be alarming, and in attempting to stop it the bowel may be perforated Because of these possibilities, hospitalization is desirable

In adenoma with malignant degeneration treatment must be individualized

The grade of malignancy is apparently invariably low but should be determined pathologically in each case, for the clinical picture of a polypoid type of frank carcinoma may be difficult to distinguish from the less malignant polyp grade 1 or 2 Of probably greater importance is clinical or pathologic evidence of involvement of the bowel wall Clinically, this is evidenced by thickening and induration of the wall and a tendency to fixation Ulceration suggests malignancy but may be due to trauma to the growth and is of little significance

In some, evidence of malignancy may be slight, with only a suggestion of anaplasia but with considerable irregularity and variation in glandular formations, i e, so called adenoma malignum In others, the tumor is obviously malignant Recurrence is suggestive but not necessarily conclusive evidence of involvement of the wall

Multiple tumors are not infrequent and may not show the same characters

There is more or less agreement on radical operation for these malignant polyps Smiley has not regretted local removal or destruction and he believes that removal of the entire rectum is not justifiable without conclusive evidence of bowel wall involvement Every effort should be made to examine such patients at regular intervals for at least three and preferably five years after removal of the tumor

Occasionally a frank high grade malignancy closely resembles a sessile benign polyp, and diagnosis is made only on careful visualization and if possible palpation, and on repeated biopsy if there is any doubt In these,

the most conservative treatment appears to be radical resection, and any variation must be justified by unusual circumstances Such tumors probably originate as carcinomas, and the wall is involved early with possibility of early involvement of the lymph nodes Local treatment may seem indicated, but fulguration of such lesions has been unsatisfactory

Robert S Grinnell[6] (Columbia Univ) has studied *the lymphatic and venous spread of carcinoma of the rectum* in 75 specimens cleared by the modified Spalteholtz technic and concludes that use of this method greatly increases the number of node metastases found and aids in more accurate prognosis

The main extramural lymphatic spread is upward along the superior hemorrhoidal vessels It tends to remain localized and to extend slowly in most cases More distant spread, often discontinuous and unpredictable, is not uncommon, however Lateral lymphatic spread along the middle hemorrhoidal vessels is probably infrequent and of secondary importance, occurring chiefly when the higher nodes are blocked by metastases Downward lymphatic spread is exceedingly rare and only occurs by retrograde flow when the high nodes are blocked The rare occurrence of downward extension suggests that anterior abdominal resection, with ligation of the superior hemorrhoidal vessels, may have a wider field of usefulness for tumors near the rectosigmoid junction Metastasis to the paracolic nodes is rare except in cases that are probably beyond operative cure Perineal excision is a completely inadequate operation, even for carcinomas lying below the pelvic peritoneum The tendency of rectal carcinoma to metastasize by way of the blood stream varies, in general, with the degree of differentiation of the tumor and with the extent of local spread, as outlined by Dukes Blood stream metastasis before the muscle wall of the rectum has been completely

(6) Ann Surg 11[illegible] 00 16 August 1949

penetrated by the tumor is probably rare Blood borne metastasis after complete penetration of the muscle wall, but before the regional nodes are involved, is not as rare as has been believed The value for prognosis of both the grading of tumors and their classification according to local spread has been further demonstrated Failure to find local blood vessel invasion in the tumor after careful search is strong evidence that no visceral metastases exist

Electrosurgical Treatment of Rectal Cancer—A H Roffo and Felipe Carranza[7] present some statistical data on the 926 cases of rectal cancer seen at the Institute of Experimental Medicine of Buenos Aires from 1928 to 1941 and compare the results of roentgen and radium irradiation with those of radical electrosurgical treatment They consider the latter the treatment of choice, as their personal experience shows a cure for more than five years in 50 per cent of the cases This figure applies to 261 patients on whom they performed the intervention, with an operative mortality of 2 per cent

Anus.—*Rôle of Anal Glands in Pathogenesis of Anorectal Disease*—Malcolm R Hill, E Harold Shryock and F George ReBell[8] (College of Med Evangelists) studied structure distribution and relationship of the anal glands in 1 seven month fetus 5 new borns and 11 adults The glands manifested wide individual variation as to number, depth of penetration and contour Lack of complete canalization of the terminal portion of the glands was observed in three new borns In some adult specimens the cells lining the glands presented apical cytoplasmic vacuoles which stained positive for mucin Appearance of a cyst of the tubular portion of a gland further suggested secretory function Smooth muscle in the submucosa of the gland bearing area varied in thick

(7) Bol Inst. de med. exper para el estud. y trat. d cáncer 18 102 1082 December 1941

(8) J A M A 121 742 746 Mar 6 1943

ness and stages of development Variable lymphocytic infiltration was noted in all cases and was considered of nonpathologic significance

Various traumatic, bacterial and constitutional factors unite to permit infection to spread via the anal gland system Extension of glands beyond the anorectal line into the rectal submucosa offers a logical explanation of occasional occurrence of abscess and fistula in this region Deep penetration of a gland extending into the internal sphincter points to possible avenues of invasion along muscle bundles, fascial planes and adjacent structures to these lines of cleavage One adult had a definite gland cyst, which supports the claim that abscess and fistula may develop without communication with the anal canal Primary carcinoma originating in the perianal tissue can occur, perhaps following chronic trauma, with glandular cyst serving as nucleus for development Assumption that anal glands in man are vestigial remains and function only in animals was not supported by the study Instead, these glands are evidently active as secretory structures throughout life

Treatment of perianal abscess and fistula requires application of fundamental surgical principles, modified by the peculiar anatomy of the part W F Gillespie[9] (Univ of Alberta) describes the surgical anatomy of the anal canal and insists especially on the external sphincter which is molded around the internal sphincter and the longitudinal muscle like a ring on a finger, or like the prostate around the vesical outlet

The subcutaneous portion is a thick bundle of muscle fibers forming a ring immediately under the skin and having no prolongations anteriorly or posteriorly It lies just distal to the internal sphincter and is easily palpable in its whole circumference, with a groove above it, called the anal intermuscular septum marking separation of the muscle from the internal sphincter

(9) Canad M A J 4 54 5 1 December 1942

The second part, the superficial portion, forms an ellipse as it reaches its attachment to the coccyx and the central point of the perineum It lies above the subcutaneous portion but is separated from the latter by fascial extensions of the longitudinal muscle Within the grip of this muscle is the internal sphincter

The third part, or deep portion, is also a circular bundle of fibers with no anterior or posterior attachments

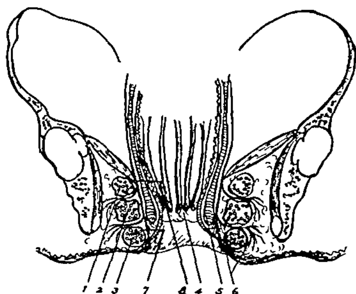


Fig 163 —External sphincter 1 deep portion 2 superficial portion 3 subcutaneous portion 4 anal crypts and papillae 5 internal sphincter 6 fascial insertions of longitudinal muscle 7 anal intermuscular septum 8 anorectal ring

Its lower margin is usually related closely to the superficial portion, and its upper margin fuses with the levator ani (Fig 163), especially the puborectalis portion of the latter

Clinically, these structures afford three valuable landmarks subcutaneous portion, anal intermuscular septum and anorectal junction, which offers a definite ring to the examining finger This anorectal ring consists of the so called internal sphincter longitudinal muscle pu

borectalis portion of the levator and the deep portion of the external sphincter The puborectalis is a U shaped muscle which acts as a sling to fix the canal to the pubic bone The ring is much thicker posteriorly than anteriorly because of this muscle Anal continence depends on integrity of the anorectal ring, and this structure must never be completely divided

Figure 163 shows distribution of fascial terminations of the longitudinal muscle which reach toward the skin, particularly between the subcutaneous and deeper portions of the external sphincter, reminiscent of the two layers of the sphincter cloacas These fascial strands may be important factors in determining the pathways taken by infections extending outward from the anal canal

The inferior mesenteric vessels, stretching from Alcock's canal to the anus, enter chiefly in the posterolateral quadrants, and these pathways explain why most fistulas are located in these sectors Similarly, lymphatic drainage offers an avenue for infection Attention has recently been directed to the anal ducts, Tucker and Hellwig dissected 89 specimens to show the openings of these tiny epithelial tubes into the anal crypts and emphasized the possibility of these being pathways for extension of anal cryptitis into outlying tissues

Most ischiorectal abscesses arise from infection in anal crypts Why the anal crypt should become infected is not understood But once having begun, the anatomy explains how it extends *The sequence of events* is cryptitis, extension by lymphangitis or otherwise, and abscess in the ischiorectal fossa which is a relatively rigid cavity that can hold scarcely 2 oz fluid In these rigid walls the fatty tissues resist but feebly the suppurative processes, and extension inevitably occurs and follows the line of least resistance, passing along the original tract back to the crypt and converting a minute pathway into an actual tube Later the skin ruptures or is

incised, and a fistula is formed In some cases, extension travels deep to the posterior raphe to the ischiorectal fossa of the opposite side As many as 40 per cent of acute ischiorectal abscesses may have established gross openings into the anal canal by the time operation is undertaken

Treatment of ischiorectal abscess should be early operation before fistula formation, even when an abscess is only suspected Given a patient with the usual history of throbbing perianal pain, the area of the anus should be palpated with finger and thumb A point of slight induration which is definitely tender reveals the diseased area A large portion of skin is removed and the tension thus relieved Length of the incision should be at least twice the depth of the abscess Examination of the cavity should be made gently to ascertain whether a fistula already exists However, unless the pathway is superficial, it should not be treated further at this time A square of vaseline gauze is placed on the wide shallow wound Packing must never be used Occasional dressings, tub baths after bowel movements and gentle irrigations with saline solution are all that is required If this operation is done early the number which go on to actual fistula will be reduced

Treatment of anorectal fistula is saucerization However, integrity of the sphincter raises an anatomic problem, the solution of which depends on establishing the relationship of the tract to the anal musculature

The first problem is to find the main course of the fistula Palpation furnishes much assistance for, with the forefinger in the canal and the thumb pressing about the orifice, a firm cordlike mass may be felt which represents the scarred track of the fistula Then with an anoscope in position a hooked probe explores the various crypts in the involved sector If this proves unsatisfactory a flexible probe may be gently passed from the secondary, or skin opening and made to pre

sent through the primary opening in the crypt Rarely is injection of dyes and radiopaque solutions needed

Fistulas may be classified conveniently into subcutaneous or submucous (about 36 per cent), anal (those opening into the canal below the anorectal ring) and anorectal which extend above the anorectal ring, no matter where the primary opening is found About 85 per cent belong to the first two groups

The main tract is mapped out by a probe or grooved director and its relations to the anal musculature are determined by palpation If the anorectal ring is not involved the probe is boldly cut down on, converting the tube into a trough which is widened by cutting off its edges and extending the incision radially Radical sacrifice of tissue is necessary In cutting the muscle, care must be taken to cut cleanly and radially to the fibers A third of the cases will be subcutaneous but most will require sacrifice of the subcutaneous portion of the sphincter If there is difficulty in determining the exact relation of the tract to the musculature, it is wiser to do a two stage operation At the first saucerization is carried down to the muscle and a stout ligature of silk is loosely tied through the tract and around the muscle fibers After two weeks, the scar will prevent too wide separation of the muscle when it is divided The anorectal ring must never be divided under any circumstances The operation is completed by searching for and boldly dividing the secondary lateral tracts so that none of the ramifications remains tubular

Postoperative care is simple but exacting The wide wound is dressed with vaseline gauze gently spread over its surface never packed Dressings are renewed daily until the wound is covered with healthy granulations The bowels are allowed to move by the third day and the patient is put on a full diet which will provide a formed stool After defecation the wound is gently but thoroughly irrigated with saline After a few days the patient is

encouraged to go to the toilet and then to sit in warm bathwater a few minutes before a fresh dressing is applied After the fifth day the surgeon passes a well vaselined finger into the anal canal daily to smooth out the folds and prevent "bridging," which would spell failure In two weeks or so the field is a clean, superficial granulating wound that is practically painless The patient becomes ambulant, but still requires daily inspection by the surgeon who is on the lookout for missed lateral tracts These can now be recognized as pearly gray snail like patches in the healthy red granulations *Such areas must be freely opened at once*

Failures will likely be due to one of three causes The internal opening has not been opened, lateral offshoots have not been recognized, or too conservative an operation has permitted bridging Incontinence is avoided by protecting the anorectal muscular ring dividing the sphincter only once and never obliquely and avoiding packing

Tuberculous infection occurs in 10 to 15 per cent of fistulas If the patient's general condition is satisfactory the local lesion can be dealt with radically If the general condition is unsatisfactory the surgeon must approach the local lesion with utmost caution and conservatism

Fissure in Ano—Edward T Whitney[1] (Boston) shows how three factors are involved in the genesis of a fissure in ano at the posterior commissure An anal gland becomes prey to infection which ultimately is combated by production of fibrous tissue, especially in the neighborhood of the fibro muscular longitudinal muscle Fibrosis here results in a Pecten band which strangulates the duct or neck of the gland producing an intersphincteric abscess Rupture of the latter through the anal wall creates a round or oval ulcer which, when the anus is not dilated looks like a fissure or crack

(1) Am J Surg 59 9 1 *January 1943*

Logical treatment requires elimination of the underlying causative condition, accomplished by excision of the infected anal gland and Pecten band and adequate drainage of the abscess by posterior sphincterotomy

A *radical operation for intractable pruritus ani* is described by Forrest Young and W J M Scott[8] (Univ

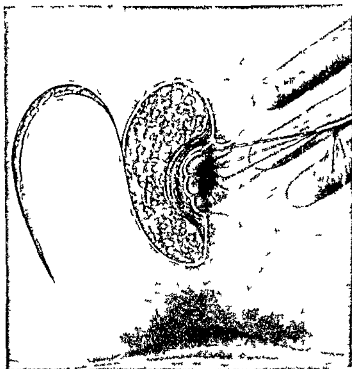


Fig 164 —Manner in which flap is cut for resurfacing one half perianal area

of Rochester) It consists of complete excision of the scarred perianal skin, one hemisphere at a time, and shifting of a flap from the medial surface of the buttock and thigh to replace the excised area The flap need not be delayed because the blood supply is entirely adequate

TECHNIC —An incision is made at the mucocutaneous junction around one half the circumference of the anus The

(8) Surgery 13 911 915 June 1943

mucosal edge is prevented from retracting inward by a number of guy sutures which are held by an assistant The external sphincter muscle is exposed, and the scarred skin and subcutaneous tissues are dissected from it A plane of dissection is found under the leathery area and dissection carried outward to normal skin The flap of scarred tissues is cut away (Fig 164) A flap of skin and subcutaneous tissue of correct size and shape to cover the defect is cut lateral to the defect with its base posteriorly and is swung across and sutured to the anal mucosa and the medial line of excision The defect left laterally is sutured as far as possible and the remainder left to granulate The operation is done in the lithotomy position, and any tension on the flap becomes less when the legs are straight again A small rubber drain is brought out from under the flap at its base, and a snug perineal binder is applied to hold the flap securely in apposition to its bed The bowel is prevented from moving for 10 to 14 days depending on the speed of healing There is usually some inflammatory reaction along the suture lines, but not enough to interfere with healing In two to three months the remaining half of the perianal skin is removed and replaced in the same manner

So far three such patients were operated on Two are free from symptoms long enough to be thought permanently relieved The third is about to have the second stage of the operation done

Domingo Pescuma[7] (Buenos Aires) reports a case of *epithelioma of the anal border*, the size of a hen's egg, which was treated with radium Evolution of the tumor was observed in 20 biopsies done at regular intervals

Treatment was given in two stages (1) Interstitial, with 10 radium needles of 3 33 mg placed 1 cm apart like the spokes of a wheel through the pedicle of the tumor, 0 25 mcd per hour, total dose 59 mcd Slight contraction of the tumor and disappearance of hemorrhages occurred (2) Superficial moulage containing 14 radium tubes of 6 66 mg , 1 mm Pt, 0 6 mm Au and 2 mm Pb filter focal skin distance of 2 cm to irradiate a surface of 56 sq cm , 0 70 mcd per hour, total dose 134 40 mcd in eight days There were nearly complete disappearance of the tumor and frank erythema

One month later, there was intense radiodermitis of the treated region Two months after treatment, the tumor was one

(7) Semana méd 50 94? 947 Apr 29 1943

fifth its original size and consisted of two hard nodules covered by smooth skin and seemingly consisting of sclerosed tissue Infiltration of the sphincter and terminal part of the rectum was greatly decreased

Pedicle Skin Grafts in Correction of Cicatricial Anal Stenosis —Patients with imperforate anus frequently develop such a severe stenosis, particularly following inadequate operation at birth, that the ordinary plastic procedure is unsuccessful In an effort to treat these

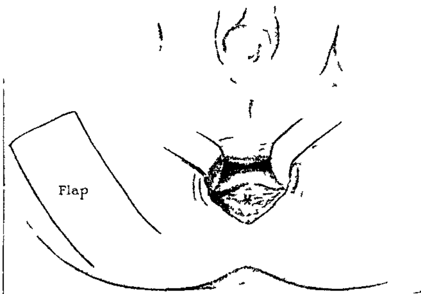


Fig 165 —Two or three weeks after outlining a flap on the buttock as illustrated a second operation is performed in which the scar tissue at the stenosed anal opening is cut through posteriorly and the area dilated to make room for the skin graft (Fig 166)

severe types Warren H Cole and Paul W Greeley[9] (Univ of Illinois) have used a pedicle skin graft on the assumption that the chief cause of failure in the other plastic procedures was insufficiency in the amount of normal elastic skin

TECHNIC —A temporary colostomy (double barreled, with out tissue intervening) is made in the descending colon ~o

(9) Surgery 1~ 349 354 September 194

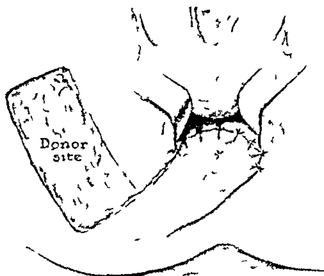


Fig 166 —Skin flap is mobilized and swung over to the midline anchoring the end to the edges of the defect freshly made by the incision posteriorly

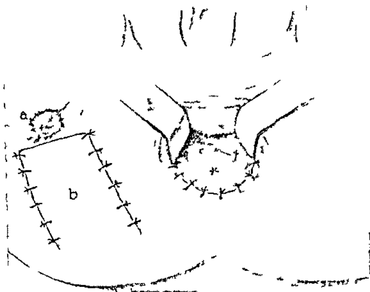


Fig 167 —Two or three weeks after transplanting the flap to the anal opening the flap is cut transversely the distal end fixed with sutures to the anal defect and the proximal portion transplanted back to the original site

that the anal surgery may be carried out in a clean operative field About two weeks later, a pedicled skin flap is elevated from the buttock lateral to the anal opening It should be long enough to reach the anal defect without tension and wide enough to cover it completely Two or three weeks later, an incision is made from the stenosed anus posteriorly and up ward to the rectal mucosa The opening is dilated, leaving a V shaped defect (Fig 165) The flap is mobilized transferred to the anal defect and secured to the cut edges of the mucosa (Fig 166) A plug of 3 per cent xeroform vaseline gauze is placed in the rectum to exert moderate pressure against the end of the flap to guard against passive congestion The donor site is temporarily covered with xeroform vaseline gauze and dry dressings The wounds are dressed sufficiently often to insure surgical cleanliness, and the flap is left in this position for three weeks The silk sutures either cut through and are extruded spontaneously or are removed in about 10 days

After three weeks, the flap is divided and the free end of the distal portion is sutured to the skin at the anal outlet (Fig 167) The unused part of the flap (Fig 167*b*) is returned to the donor site and fixed with interrupted cotton or silk sutures The balance of the donor site (Fig 167*a*) is permitted to fill in by secondary intention, although a split skin graft may be applied The skin sutures are removed in 7 to 10 days, when all wounds are healed Any time after that, the temporary colostomy is closed

This technic was used in two cases with gratifying results There is no incontinence unless diarrhea is present

George F Eubanks[3] (Atlanta Ga) discusses *post operative management of anal surgery* Properly it be gins before operation continues through operation and for as long postoperatively as the patient has any symp toms or recurrence of anorectal disease

Careful and thorough yet gentle original examina tion will pay dividends in postoperative comfort Also, an early impression of roughness formed in the mind of the patient is difficult to eradicate later and such fixa tion will cause him involuntarily to exaggerate the in evitable postoperative discomfort Immediate preopera

(3) South M J 36 9 32 January 1943

the preparation for surgery of this area is fairly well standardized and involves basically cleansing of the bowel, local preparation of the skin and satisfactory sedation It is advisable to allow a liberal supper, preferably containing only moderate residue, the night before operation

The operation is scheduled for as early as practical for the operating room staff Selection of anesthetic is of great importance Low lumbar anesthesia more nearly fulfils requirements than any other Use of 10 to 12 mg pontocaine dissolved in 3 cc spinal fluid and injected in about 20 seconds with the patient horizontal on his left side produces less systemic reaction than the 45 cc of 1 per cent procaine usually injected for caudal and parasacral anesthesia Contraindications are spinal deformities, previous meningitis or acute anterior poliomyelitis and frail patients with marked organic hypertension In these, local infiltration with procaine, pentothal sodium or cyclopropane is used

Care and gentleness, avoidance of forcible divulsion of the sphincter and minimal use of suture material reduce infection, sphincter spasm and postoperative pain Tubes and packing delay healing The provision of radially situated areas of skin excision corresponding to the areas of excision of more proximally located diseased tissue, producing a drainage gutter for each wound, promotes healing and prevents many postoperative infections subcutaneous abscesses and tag formations Use of infiltration anesthetic of prolonged action at the time of operation has a definite place in the control of postoperative pain

Postoperative Management —Following operation, a tightly fitting adhesive dressing placed over an inverted wedge of fluffed gauze splints the anus, promotes comfort and controls any tendency to bleed from the areas of skin excision This reduces the number of external ligatures to the minimum required to control arterial bleeders This dressing is removed six hours after operation at which time hemostasis is complete,

and hot (110 F) dressings of mercuric iodide are applied continuously, directly to the operative area The patient is allowed out of bed to void, if necessary, any time after removal of the dressing Aspirin and codeine are ordered and, if they do not render the pain tolerable, dilaudid is administered hypodermically The anesthetic used will usually render the patient entirely comfortable for four to six hours postoperatively, and then the local moist heat greatly relieves the sphincter spasm which is the greatest source of pain There is no interruption of diet except that only liquids are given for breakfast before operation The day after operation the patient receives two to four hip baths at a temperature of 110 F This, next to careful surgery, is the greatest factor in pain control These baths, at least two daily, are continued throughout the entire period of healing Starting the day after operation the patient takes a hydrophilic laxative daily until healing is complete and normal bowel function re established

Direct wound care begins after re establishment of evacuation It consists essentially of local cleanliness and observation for possible complications Careful cleansing with a cotton tipped applicator, gentle irrigation with witch hazel and a mild local antiseptic, such as solution of metaphen are used daily until epithelial regeneration is well advanced This takes usually about two weeks The dressings are done less frequently thereafter, but the patient is examined at least once a week until all healing is complete The usual period of hospitalization is 5 days and the usual time of immediate office care 14 days

A regular system of follow up is essential if recurrences are to be prevented Patients are requested to return for examination at intervals ranging from one month for the first six postoperative months to three months for the remainder of a two year period At these examinations careful check is made of the size of the canal, presence of skin tabs subject to irritation and possible reappearance of internal varices or mucosal redundancy When such conditions are apparent, suitable treatment instituted while the disease is in an early stage will prevent the necessity of further radical surgery

This plan has been gradually evolved in management of 2,463 operations for anorectal disease other than

malignancy In this series, 1 26 per cent had postoperative headache lasting two days to two weeks, 15 9 per cent required catheterization, 40 2 per cent required one dose of dilaudid, 3 49 per cent required two to five doses of dilaudid, 0 44 per cent required second hospitalization and proctotomy or other plastic procedure for constriction of the canal, 1 18 per cent required superficial proctotomy as office procedure for constriction of canal, and 0 08 per cent required a second radical hemorrhoidectomy

Con Amore V Burt and Edwin J Pulaski[4] (New York City) recommend *zinc peroxide dressing for postoperative anorectal wounds,* because it does not produce any generalized or local toxic manifestations and is safe in all types of anorectal wounds, both local and abdominoperineal The packing does not adhere to the raw surfaces and hence is easy to remove, it does not produce oozing on removal, is hemostatic and tends to reduce the postoperative capillary oozing False union of the raw surfaces is prevented by the deposit of solid particles of zinc peroxide

TECHNIC —Usually 2 3 tablespoonfuls of zinc peroxide powder, previously sterilized in a test tube fitted with a cotton stopper, is placed in a small mixing basin Sterile distilled water or normal saline is slowly poured over the powder which is stirred until a suspension of about the consistency of heavy cream (40 per cent) is obtained A piece of 1 in plain packing, 12 18 in long, is soaked in this suspension and folded to a length of about 3 in With a plain forceps grasping the free end, the packing is inserted through the anal canal without wadding up the end to form a bulbous extremity It is so placed that it covers the entire raw surface and prevents any false adhesion of these surfaces The packing molds itself into the anal canal and fills any cavities or crevices, but does not produce any discomfort, even if it becomes dried out and hard Vaseline gauze placed over the packing and entire anal region tends to prevent drying Then plain gauze covered by adhesive straps to exert pressure and hold the dressing in place, is applied All packing is usually removed after 24

(4) Surg Gynec & Obst 75 65 6 December 1942

hours and rarely replaced even in the case of fistulas It may be left in place for four or five days until granulations have formed

Following removal of the packing, hot sitz baths are instituted twice a day, mineral oil, ½ oz, is administered twice a day, and a cathartic is given on the night of the first postoperative day, followed the next morning by an enema if necessary The hospitalized patients are discharged on the third to fifth postoperative day, usually on the fourth

In abdominoperineal resections, the most satisfactory packing has been a large abdominal laparotomy pad soaked in the zinc peroxide suspension This pad lines the entire raw surface of the true pelvic cavity below the new peritoneal floor The space within the pad is then filled loosely with plain or iodoform gauze, which is partially removed on the first or second postoperative day By the fifth day all packing, including the zinc peroxide pad, is removed without pain or oozing A grayish white surface remains for three or four days due to the mechanical deposit of zinc peroxide particles over the raw surfaces In the course of two or three days more this surface materially clears, healthy granulations appear and healing proceeds perhaps more rapidly than following other types of packing One great advantage of zinc peroxide packing, in general is that it may be kept in place for days without producing a bad odor

Pilonidal Cysts—According to Chas Gordon Heyd[5] (New York City), the draft boards and physicians in charge of induction are revealing a considerable number of "alleged" pilonidal cysts Recently he was consulted by three physicians in good physical condition but rejected because they showed in the median raphe at the base of the spine one or two small "dimples" They were hardly larger than the head of a pin and did not admit a probe, yet diagnosis was pilonidal cyst and the applicants were rejected for a commission in the Medical Corps They had no symptoms suggesting a pilonidal cyst, and diagnosis seemed dubious

In the last decade, operative procedures for pilonidal cysts have tended to become more and more radical, with removal of large areas of integument and subcutaneous

(5) New York State J Med 42 21 9 130 Nov 15 1942

tissue, in the expectation of excising well beyond the margin of any cyst wall or its ramifications Fully half the cases become infected and break down, leaving a large granulating area which requires months to heal A minimum of 10 to 14 days' hospitalization and 8 months with a painful, discharging wound is too great a price to pay for such a condition

Heyd describes a safe efficient office treatment for infected or noninfected pilonidal cysts, used in at least 25 cases Two technics are available depending on the condition of the cyst

TECHNICS —*Group A Noninfected Pilonidal Cyst* —Under 2 per cent novocain local infiltration, a longitudinal, elliptical incision 2 5 cm is made, excising the median raphe and about 1 cm skin including all "dimples" The ellipsis of skin carries with it an excision of the same amount of tissue from the skin surface to the periosteum of the sacrum Hemostasis is assured and the wound packed rather firmly with gauze saturated with the Carnoy Cutler solution

Absolute alcohol	6 cc
Chloroform	3 cc
Glacial acetic acid	1 cc
Ferric chloride	1 Gm

Group B Infected Cysts with One or More Discharging Orifices —These patients have had one or more previous operations, varying from simple drainage to radical excision The same technic is used as in group A except that there is a wider ellipsis of excision including all sinus orifices The effect of the sclerosing solution is to destroy all the secreting membranes The lateral walls of the cavity remain rigid and the skin edges will not contact or turn in, so the cavity must be closed by granulation from below upward The original gauze saturated (but wrung out) with the sclerosing fluid is left in situ for 48 hours After this, plain gauze is inserted for a second 48 hours Then gauze saturated but wrung out is inserted in the wound for a third 48 hours Following this, plain gauze is inserted twice a week until healing is completed.

Olecranon or Patellar Bursitis —Here the technic is slightly modified On the first visit, a fairly large aspirating needle is inserted at the lowermost fluid level and a 16 mm needle is

inserted into the sac at the uppermost fluid level The fluid contents are aspirated through the lower needle and 1 cc sclerosing solution is injected through the upper needle For six to eight hours there is considerable pain, requiring some anodyne After 24 hours, an ellipsis of skin is excised and treatment then carried out as in group A The author submitted to this therapy for right olecranon bursitis with complete healing in 18 days and no loss of time from practice

Isidore Cohn[9] describes the *operation for pilonidal sinus* which he has used for 14 years at the Touro In-

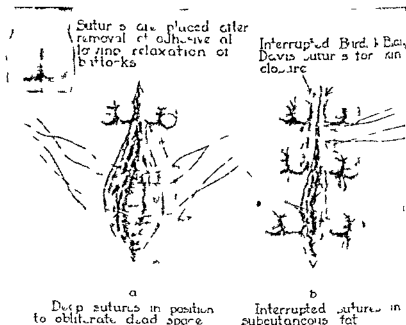


Fig 168 —Method of introducing longitudinal sutures and wound closure.

firmary and Charity Hospital of New Orleans The main point of variance with other procedures is the application of mattress sutures at a distance from the wound edges and not crossing in the midline, but coming out on the same side (Fig 168)

After care of the patient is particularly important He should be kept in the prone position and not be

(9) Am J Surg 61 61 66 July 1943

allowed to be up and walking too soon If the patient walks or sits down soon after this operation, increasing tension on the healing wound cannot be avoided, and Cohn believes that this accounts for a good many delayed healings of wounds which would otherwise unite by primary intention

William F MacFee[6] reviews 214 cases in which 230 operations for *pilonidal sinus* were performed since Jan 1, 1936 No two cases occurred in the same family There was no tendency toward association with other anomalies, but an incomplete spina bifida was present in one case

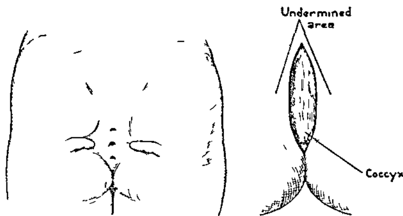
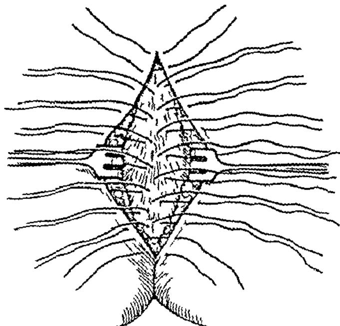


Fig 169 (left) —Typical appearance of pilonidal sinus with hair projectin from middle sinus
Fig 170 (right) —Sinus removed by block dissection with undermining of skin and exposure of sacrococcygeal fascia

The ratio of males to females was 3 1 The series contained two Negroes, but no members of the yellow and brown races Italians, Central Europeans and Jews were the largest racial groups in a mixed population All patients presented evidence of infection, and half of them gave a history of one or more abscesses which had been incised or had ruptured spontaneously Thirty two patients had had one or more previous operations designed to bring about a cure Only 13 attributed onset of symp

(6) Ann Surg 116 68 699 November 1942

toms to trauma Five of the 57 females gave childbirth as the cause of onset, and 2 others stated that symptoms began during pregnancy The youngest patient was 15



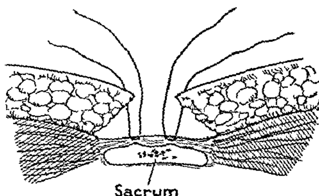


Fig 171 (top) —Sutures of black silk placed through skin edges and fascia ready for tying In passing sutures through skin subcutaneous fat is not included
Fig 17° (bottom) —Cross section

and the oldest 55 Average age of onset was 22½ years and average age at the time of admission 25 years Four patients stated that the sinus had been observed at birth

TECHNIC—The type of wound closure used (Figs 169–175) has as its principal purpose elimination of as much open

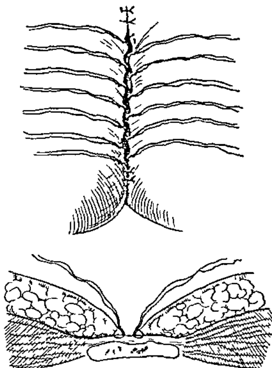


Fig 173 (top) —Sutures tied bringing skin edges to fascia near midline without tension
Fig 174 (bottom) —Cross section.

wound as possible without creating a dead space The tissue involved by the sinus is removed by block dissection and partial wound closure is effected by suturing the skin edges to the sacrococcygeal fascia and underlying ligamentous structures The skin edge on each side is brought as near the midline as possible without tension and sutured with interrupted medium black silk, leaving a narrow uncovered area of fascia between If this area is large enough to warrant it, a skin graft may be applied to shorten the period of healing further A roll of gauze or cotton wet with normal saline solution is

then applied to the wound where it may be conveniently anchored by the suture ends, which are left long enough to facilitate their subsequent identification and removal If the wound can be kept clean, it need not be disturbed for several days, but the dressing may be changed frequently if necessary

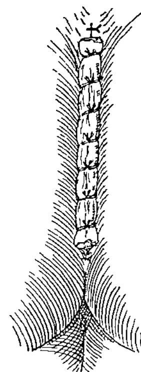


Fig 175 —Ends of sutures which have been left long are tied over a dressing roll of wet cotton or gauze as convenient means of holding it in place Wet dressing provides capillary medium for absorption of serous exudate (MacFee above)

The sutures should not be removed until the skin has become firmly fixed to the fascia This is usually a question of 10 or 12 days

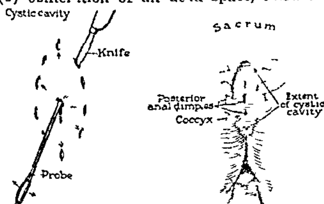
The initial results are encouraging, but the ultimate value of the method depends on further experience with it The postoperative care is important, with regard both to healing time and to incidence of recurrence

S C Woldenberg and W S Sharpe[7] (M C, U S A) studied 100 consecutive cases of *pilonidal disease* treated surgically by excision and primary closure, 80 per cent of patients had draining sinuses on admission, 10 patients had had previous operations in which some type of excision had been done, and 38 had had previous incision and drainage

A program of preoperative treatment surgical excision with primary closure and postoperative management was followed Recurrence was observed in 2 per cent Wounds healed in an average of 21 5 days and the patients were returned to full military duty in an average of 28 days, 72 per cent had completely healed wounds in 14 days and were hospitalized for a period averaging less than 25 days, they returned to duty as useful soldiers

(7) Surg Gynec & Obst 104 1 0 February 1943

Aside from pre and postoperative management five factors were responsible for these results (1) completely meticulous hemostasis, (2) avoidance of tension in closure, (3) obliteration of all dead space, knowledge of



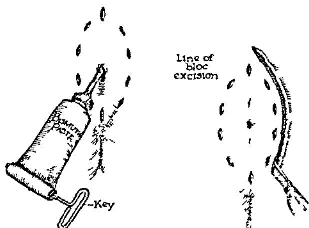


Fig 176 (top left) Fig 177 (top right)
Fig 178 (bottom left) Fig 1 9 (bottom right)
(VanAlstyne below)

anatomy of the region and care to avoid damage to coccyx and anal sphincter (4) liberal use of chemotherapy locally and generally (5) careful approximation of wound depths and edges

Pilonidal Cysts—Guy S Van Alstyne[8] (Chicago)

(8) Surgery 1 8 78 November 194

uses the following method of demarcation and closure which maps out the area accurately on the overlying skin, restores the natural groove between the nates and so entirely obliterates all space between the skin and the sacrococcygeal fascia

TECHNIC —A small probe (Fig 176) is passed through the postanal dimple (Fig 177) into the cavity of the cyst and pushed cephalad as far as possible, care being taken not to make a false passage into the pericystic tissues A small nick

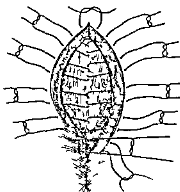


Fig 180

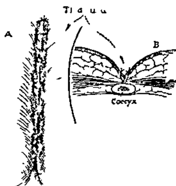


Fig 181

is made in the skin over the palpable head of the probe The position of the probe is changed to an oblique one, both right and left and the skin is nicked each time over the head of the probe as before This is continued to a transverse position, then obliquely downward and lastly directly caudad The series of skin nicks accurately maps out the cyst area on the skin surface Next a bismuth paste is injected (Fig 178) This will distend the cyst and identify any ramification, which an unwary surgeon might inadvertently cut, better than methylene blue or other dye can The cyst is excised en bloc by cutting widely round the marked out area (Fig 179)

For closure, instead of suturing the edges of the skin flaps to each other mattress sutures of heavy silk are placed close to the edge of one side, then through the deep fascia overlying the lower sacrum and coccyx in the midline or slightly past it, then back again through the edge of the same flap (Fig 180) Sufficient similar sutures are placed along each flap edge from skin to fascia and back so that when tied, each flap is folded on itself with its free edge held firmly to the bottom

of the groove in the midline (Fig 181) This procedure approximates the edges just as truly as though they were sutured to each other, with the additional advantage of entirely obliterating any possible dead space underneath One or more shallow sutures may be placed from one flap to the other (Fig 181 *A*, top suture) should there be any gap, excepting that it is wise, since these cysts are always infected and this region is close to the anus, to leave a small gap at the lower angle for draining

[The large number of cases of pilonidal cyst that have been recognized in the Army has been a surprise to everybody and is responsible no doubt for the numerous articles on this subject which have appeared recently However, despite the many new methods of mapping out the cyst and its ramifications the editor has found very satisfactory the older method of injecting a solution of methylene *blue into the sinus followed immediately by the* injection of hydrogen peroxide which forces the dye into the various ramifications.—Ed]

HERNIA

Accepting the theory that the transversalis and internal oblique fibers do not normally attach themselves to Poupart's but rather to Cooper's ligament, Henry N Harkins, D Emerick Szilagyi, Brock E Brush and Ray Williams[9] (Henry Ford Hosp) have used a hernial repair which restores the normal attachments to Cooper's ligament In this operation, termed the *McVay herniotomy*, no fascial layer is sutured to Poupart's ligament This technic was used in 131 groin hernias of several types in 109 patients during 16 months While follow up studies are not yet complete, results indicate that the procedure justifies its theoretical advantages Only one recurrence has been found The same procedure was used for all main types of groin hernias indirect inguinal, direct inguinal and femoral The fact that only one technic need be learned is another advantage of the method

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TECHNIC — Spinal anesthesia, interrupted silk sutures throughout (except for purse string sutures), skin preparation with 3 5 per cent iodine and return to manual labor in five to six weeks after operation are elements in the procedure

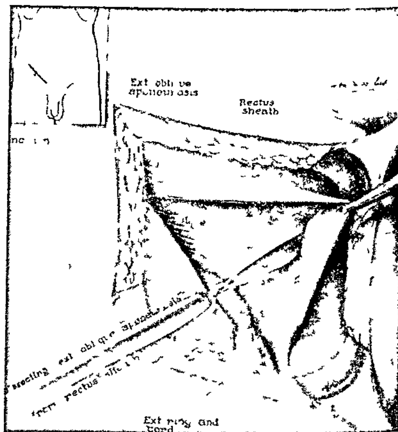


Fig 182 —Relaxation of internal oblique preliminary exposure Authors usually do the separation with blunt dissection then cut through the internal oblique aponeurosis just lateral to where it joins the external oblique aponeurosis to form the linea alba Iliohypogastric and other nerves and vessels to be avoided are not shown (From Rienhoff Surgery 8 333 1940)

The technic may be divided into 10 steps The time required is no greater than for a conventional repair

1 Exposure of the cord and opening of the indirect sac If the indirect sac is long it is bisected near the internal ring The distal segment is usually left undisturbed, but if easily separated is removed The proximal segment is grasped with

Halsted clamps which are placed at various points around the circumference of the internal ring

2 Exploration of the femoral ring and Hesselbach's triangle

3 Hoguet's maneuver If a direct weakness or sac exists, traction outward on the indirect sac will pull the peritoneum

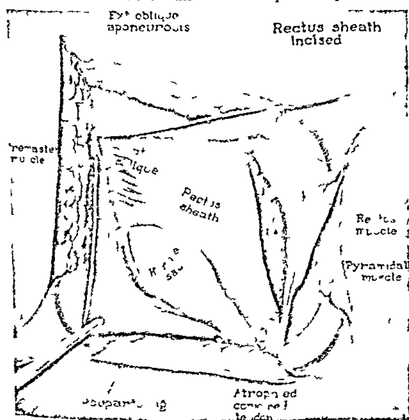


Fig 183 —Relaxation of internal oblique result. (From Pienhoff Surgery 8 34 1940)

of the direct sac external to the vessels and convert the two sacs into one The same procedure may be used to convert a femoral sac into an indirect one In some instances all three sacs may be converted into a single indirect sac

4 Internal purse string closure of the indirect sac with no 5 heavy silk Many bites are taken to include all crevices, and the suture is placed with a round noncutting needle as high as possible.

5 Plastic operation on the internal ring The defect in the

transversalis fascia at the internal ring is quite large in many instances The fascia is grasped with Allis clamps at numer ous points around the internal ring above and medially as far as the inferior epigastric vessels but not inferior to the cord and a second purse string suture of heavy silk is placed in the fascia, making a snug fit round the cord, the purse string itself does not surround the cord

6 Relaxation of the internal oblique The inner layer of the anterior rectus fascia is split for about 3 in from a point 1 5 cm above the pubic spine upward and lateralward, as shown in Figures 182 and 183 The external oblique is lifted



Fig 184 —Diagrammatic representation of sutures through Cooper s ligament (From Sterte Ann Surg 78 7 1923)

by the assistant and the internal oblique cut just lateral to the junction of the two to form the linea alba The rectus and pyramidalis muscles are exposed. The iliohypogastric and ad joining nerves and vessels which enter the rectus muscle through the internal oblique aponeurosis at this point are easily avoided This relaxation allows the internal oblique and attached transversalis fascias to be pulled down for subse quent repair without tension

7 McVay sutures The red muscle of the internal oblique is elevated with a small retractor and the conjoined tendon located with a gauze (Küttner) dissector If the transversalis fascia alone appears strong enough it is used for the upper

leaf of the repair If not, the internal oblique aponeurosis must be included, but in no case should red muscle be used. The lower leaf is Cooper's ligament. The left index finger is placed on the anterior ramus of the pubis near the spine and moved laterally along the crest until the femoral vessels are reached. This is usually about 5 cm. lateral to the spine of the pubis. Since the finger is held in close contact with the bone, keeping the vessels lateral, and the first stitch is placed medial to the finger, there is little danger of damaging the vessels. The first stitch, thus, is usually 4 cm. lateral to the pubic spine. Therefore, since the upper leaf is to be grabbed with the suture first, the needle goes through the transversalis fascia a corresponding distance of about 4 cm. from the pubic spine and then through the thick Cooper ligament on the upper border of the pubic ramus, the ligament being located by feeling the bone with the needle. The stitch is tied and the intervening gap between this point and the pubic spine closed with three or four similar sutures (Fig 184) These sutures are a double strand of no 5 heavy braided silk and are applied on a round small curved Mayo needle with a Bland needle holder The double strands are tied three times and then separated and the individual strands tied in pairs In certain cases, because of the presence of a lymph gland or doubt as to the position of the vein, the sutures are carried out only about halfway from the pubic spine to the femoral vessels.

8 Closure of the external oblique aponeurosis. In 80 instances this was done beneath the cord after the manner of the original Halsted procedure, while in the remaining 51 the cord was dropped into the space left by the McVay closure and the external oblique aponeurosis closed over it in a typical Bassini manner Fine no 1 interrupted silk is used for this and the more superficial layers There have been no recurrences by the latter method and one by the former

9 Closure of Scarpa's fascia. With small bites, the suture seems more anatomic and leaves less silk than does suture of the fat with large bites taken at random. The sutures are preferably placed so that the knot will be down.

10 Skin closure with interrupted silk and end-on mattress sutures for at least the lower third of the incision inside the hairline.

Individualization in Hernia Repair—Combining La Roque's idea of approaching the neck of the sac from within the peritoneal cavity with an anatomic dissec-

transversalis fascia at the internal ring is quite large in many instances The fascia is grasped with Allis clamps at numerous points around the internal ring above and medially as far as the inferior epigastric vessels but not inferior to the cord and a second purse string suture of heavy silk is placed in the fascia, making a snug fit round the cord, the purse string itself does not surround the cord

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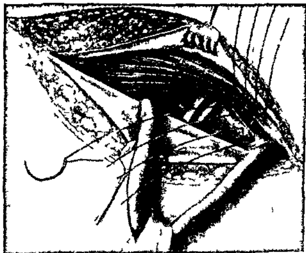


Fig 184 —Diagrammatic representation of sutures through Cooper s ligament (From Stetten Ann Surg 78 57 1923)

by the assistant and the internal oblique cut just lateral to the junction of the two to form the linea alba The rectus and pyramidalis muscles are exposed The iliohypogastric and adjoining nerves and vessels which enter the rectus muscle through the internal oblique aponeurosis at this point are easily avoided This relaxation allows the internal oblique and attached transversalis fascias to be pulled down for subsequent repair without tension

7 McVay sutures The red muscle of the internal oblique is elevated with a small retractor and the conjoined tendon located with a gauze (Kuttner) dissector If the transversalis fascia alone appears strong enough, it is used for the upper

pubic tubercle for the spermatic funiculus Closure of the aponeurosis of the external oblique either simply or by imbrication of the medial flap over the lateral, is usual When the internal oblique is thin or poorly developed, a narrow strip of the medial flap of the aponeurosis of the external oblique attached at the pubic tubercle threaded on a fascia needle is used as a continuous re enforcing suture, approximating the internal oblique to the border of Poupart s ligament

With slight modification to fit the case, this method is also applicable to direct and femoral hernias It also affords a better exposure in sliding hernia, particularly with regard to the involved portion of the bowel

Advantages are that it affords direct vision of the contents of the sac and anterior pelvic peritoneum, gives adequate exposure if attack on the hernial contents is necessary, affords approach to the pelvic peritoneum and observation of the bladder just above the junction of the hernial sac and cord structures, permits higher closure of the peritoneal cavity than is possible by any other method, avoids disturbance and distortion of the contents of the spermatic funiculus until after the peritoneal cavity has been closed, and the entire procedure can be carried out with a minimum of trauma

Inguinal Hernia—Robert Lich, Jr, and Ralph B Samson[1] (Pittsburgh) describe a *new simple and rapid method for hernial sac ligation*

TECHNIC—The sac is exposed in the conventional way and the redundant tissue extracted so that the neck is well isolated The sac is maintained under tension and a Furniss clamp applied across the point of desired ligation (Fig 185) Vision within the sac is necessarily maintained so that no intestinal loop or omental tag is caught in the jaws of the clamp After the clamp is closed and tightened a needle threaded with the suture is inserted between the jaws of the clamp and made to penetrate the entire breadth of the now corrugated hernial sac It is important that tension be maintained on the redundant sac until the needle is in place The distal portion of the sac is excised with a scalpel, the clamp removed and the suture

(1) Surgery 14 306 307 August 194

tion and repair of the inguinal region, Karl M. Lippert[1] (Lancaster, S C) offers the following technic

The skin is incised, and aponeurosis of the external oblique split and Poupart s ligament are exposed as usual The internal inguinal ring is then freed from transversalis fascia and peritoneum At this stage the next step must be determined by the amount of peritoneum disclosed by retracting the edges of the internal abdominal ring When there is a large relaxed internal ring more free surface of the peritoneum can be exposed by dividing the lateral attachment of the internal oblique muscle up for 2 to 3 cm If one experiences difficulty one can shift to LaRoque s method and make a gridiron incision to the peritoneum just caudal to the level of the ilio inguinal nerve as it crosses the internal oblique muscle Through either approach the peritoneal cavity is entered as in performing an appendectomy

A small peritoneal incision is enlarged down until the anterior wall of the hernial sac is divided The contents of the sac are returned to the abdomen after careful inspection.

A hemostat is placed on the lateral and medial sides of the divided ring of the peritoneum forming the neck of the hernial sac, and a third clamp is fastened to its posterior border By sharp dissection the sac is separated from the pelvic peritoneum ju t distal to the fold formed by traction on the three clamps The peritoneal cavity is closed by a purse-string silk suture After the knot is tied, this suture is passed beneath the internal oblique muscle above the internal abdominal ring and fastened about a small muscle bundle with care not to include the ilio inguinal nerve The procedure avoids the spermatic structures and bladder by working from above with constant direct vision of the pelvic peritoneum. The anterior wall of the sac is now divided longitudinally in its entire length A few interrupted sutures are placed medially and laterally to keep the serous surface of the sac in contact with the undersurface of the conjoined tendon and internal oblique muscle when the inguinal canal is reconstructed

Repair of the inguinal canal from this point depends on preference. Since the peritoneal cavity has been brought above the level of the internal ring Lippert prefers Ferguson s construction of the inguinal canal This consists of placing interrupted silk sutures approximating the internal oblique and a portion of the conjoined tendon to the shelving border of Poupart s ligament, leaving an adequate opening beside the

(1) S uth Med. & Surg 104 : 9 460 August 1942

ring gave a satisfactory immediate result, the remaining two patients had each had three previous operations on the hernia One of these had been operated on by Gallie's method a year previously, and a lattice work of individual strands of fascia was found in front of the spermatic cord, fulfilling no useful purpose

One patient refused operation He had been operated on four times previously and his history was briefly as follows first operation, in bed 14 days with recurrence of the hernia on the first day out of bed, second operation, in bed 21 days, with recurrence 1 month later, third operation, 1 month in bed, with recurrence before he left the hospital, where the fourth operation was performed and a fascia lata graft employed The hernia recurred immediately after he returned to duty On examination the inguinal canal was found to be sound, but he had a large femoral hernia and a muscle hernia the entire length of the outer side of the thigh The suggestion that this was a different hernia was indignantly refuted by the patient, who maintained that its size and shape had not been affected by any of his four operations

Various types of repair were encountered In one case there was no sign that the external oblique aponeurosis had been opened previously, and in three cases the large sac could be seen on exposing the cord before its coverings had been disturbed

Insult to the Testicle in Herniorrhaphy—Joel W Baker and Matthew Marpur Evoy[1] (Seattle) report that of the last 100 patients operated on for inguinal hernia at Mason Clinic, only 2 developed immediate, detectable, postoperative testicular swelling That they have been fortunate is suggested by comparison with 150 patients of the Lahey Clinic 6 7 per cent of whom developed shortly after operation some evidence of atrophy of the testicle on the side operated on

(1) Surg Gynec. & Obst 75 285 288 September 1942

pulled into position and tied This will effect a tight purse-string closure of any peritoneal sac irrespective of its fragility and width, provided it can be placed within the jaws of the Furniss clamp Only a minimum of devitalized tissue remains after sac closure Use of the clamp will reduce the operating

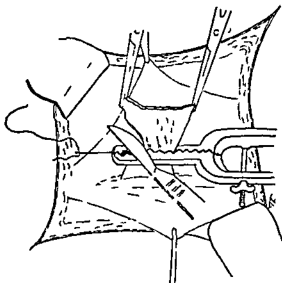


Fig 185 —Furniss Clute clamp applied with needle in place and amputation of hernial sac in progress.

time by several minutes and converts an often troublesome technical labor into an incidental step of the operative procedure

N Heath, J J Mason Brown and K G W Saunders[3] (R A M C) found that 16 of 19 cases of *recurrent inguinal hernia* were due to inefficient operative technic in that the original sac had not been removed It is axiomatic that the essential part of the operation for oblique hernia is isolation and complete removal of the sac and that the method of repair is of secondary importance

In three cases no sac could be found One patient had had no previous repair, and closure of a large internal

(3) J Roy Army M Corps 78 283 284 June 194

Passive congestion of the testicle can be responsible for (1) dilatation of the veins in the pampiniform plexus, (2) hydrocele from passive transudation, (3) lowered tissue resistance and, hence, active infection from a dormant local condition or a circulating organism that ordinarily would not find such a favorable medium, (4) most important, increased intratesticular tension which may become severe enough to cause pressure necrosis of the parenchyma and ultimate atrophy of the testicle It is hard to believe that passive congestion alone can cause this unless venous return is blocked completely The most likely explanation is that tension sufficient to enlarge the testicle is the result of passive congestion plus a subacute inflammatory process Ordinarily, exudation produces more tension than pure transudation This belief is supported by observations of Erdman that atrophy developed in cases diagnosed epididymo orchitis or hematoma

Treatment is first preventive, and in herniorrhaphy the requisites are establishment of an adequate aperture for passage of the cord, reduction of the bull of the cord (Halsted) and minimizing the trauma to the tissues Careless reduction of cord bulk has been reported as a probable cause for postoperative atrophy of the testicle

Curative treatment must aim at exploration of the repair and widening of the passageway for the cord or at dividing the capsule to forestall possible pressure necrosis This latter method was chosen in one of the authors' two cases when the testicle had enlarged painlessly to 1½ times normal 24 hours after operation

TECHNIC—For incising the capsule the authors use a straight incision from pole to pole on the exposed surface of the organ (Fig 186) This insures the greatest possible relief of capsular restraint Immediate evagination of the parenchyma as the incision is made is an argument for rather than against this method Multiple slit incisions have been used by

In a study of the histories of 1,093 patients operated on for inguinal hernia, Erdman found 13 1 per cent of postoperative tumefactions in the scrotum In his series, 4 6 per cent developed early hydroceles which contained 20 60 cc clear yellow fluid Outside the hydroceles, he classified other tumefactions as distention of the veins in the pampiniform plexus, thrombosed veins, thickening of the tunica, hematomas and epididymo orchitis In most of those classified as hematomas and epididymo orchitis, atrophy of the testicle subsequently developed In this group 11 patients (1 per cent) complained of pain in the groin or scrotum for 3 months to 2½ years, and Erdman believes that one half of these probably had nerve involvement Of these, 1 5 per cent developed postoperative atrophy of the testicle

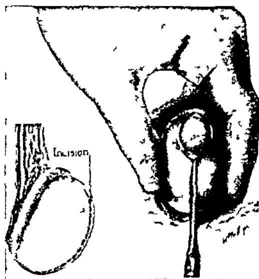


Fig 186 —Continuous straight incision from pole to pole is made Site of choice is directly opposite the root of the organ

Any complication involving the genital organs or their vicinity has a devastating effect on morale, especially of the younger adult The commonest disorder of the testicle following inguinal herniorrhaphy is passive congestion from obstructed venous return In some, even with the gentlest manipulation, local vasoconstriction is marked, while in others necessary vigorous manipulation leaves no demonstrable after effects

Starting with the medial suture each is tied separately, bringing Poupart's into contact with Cooper's ligament and snugly closing the femoral ring (Fig 187 3)

Additional sutures of finer material are used to unite the

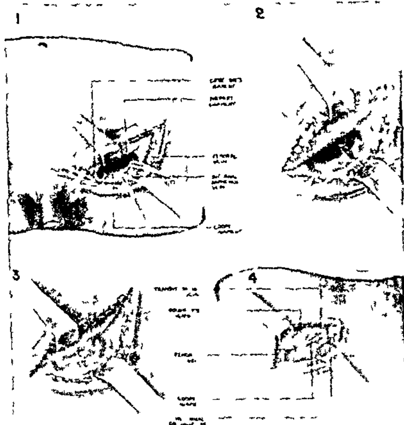


Fig 187 —1 sutures placed through Cooper s ligament Poupart s ligament is depressed and retracted with small curved retractor 2 sutures passed through Poupart s ligament taking a broad shallow bite 3 on tying sutures femoral ring is completely obliterated. 4 incision has been made through entire abdominal wall to permit inspection of repair of femoral hernia from above looking at it *from this aspect* it is seen to have closed the femoral ring as snugly as though sutures had been placed from above Poupart s ligament

lowermost border of the external oblique to the pectineal fascia and thus reinforce the repair by closing both openings of the femoral canal

The superficial fascia is closed the skin approximated and

others to release much of the internal pressure and still retain capsular tissue throughout Hot wet packs are applied after closure, and a small Penrose drain is left in the incision Local infiltration anesthesia was used

In the other case, nothing was done, and marked atrophy followed in four months

Femoral Hernia—S W Moore[4] (Cornell Univ) describes a *procedure for femoral hernia* which combines the better features of the two standard types of operation

TECHNIC—An incision is made over the lower border of Poupart's ligament starting at the pubic spine and extending two thirds of the distance to the anterior superior iliac spine The lower border of the external oblique fascia is cleaned and the dissection continued down to the saphenous opening The hernia is freed of its superficial layers and the peritoneal sac opened, dissected free and pulled down to a point where high ligation can be done. After ligation, the sac is excised and the stump allowed to retract All fat and areolar tissue are carefully removed until the femoral canal and ring are in full view Dissection with gauze brings Cooper's ligament into the field. Poupart's ligament is retracted toward the umbilicus with a small curved retractor which serves also to depress this ligament A gauze pad beneath the tip of the retractor protects the peritoneum Sutures, usually three, are passed through Cooper's ligament before being introduced through Poupart's A small, full-curved needle with a cutting edge is best for this purpose The first suture is taken through the outer edge of Cooper's ligament near the pubis and should include Gimbernat's ligament A deep bite brings the needle out on the inner side of the ligament where it is pulled through and left on the suture (Fig 187, *1*) If the surgeon encounters difficulty in placing this suture he may find it easier to accomplish from the far side of the operating table The last of the sutures should be close to the femoral vein but not so near as to compress it

Each needle, still threaded on the suture through Cooper's ligament, is passed through Poupart's, but this time from inside outward (Fig 187, *2*), a broad shallow bite being taken of the lower margin of the ligament If a deep bite is taken there is danger in the male of including the spermatic cord in the suture

(4) Surgery 13 145 151 January 1943

Pavlovsky differentiates eventration, congenital diaphragmatic hernia and hernia through the esophageal hiatus by the following characteristics

In eventration the stomach is generally not bilocular, but large, sometimes reaching the clavicle It has the form of an inverted U Its insufflation does not prevent observation of the diaphragmatic dome The diaphragm is seen above the raised stomach and intestine, best with a pneumoperitoneum or pneumothorax The triangle of Pierre Duval is present between the large bulge of the stomach, diaphragm and colon As the air chamber of the stomach is below the diaphragm, the pulmonary structure is not observed through it There are no convergent gastric folds The findings are roentgenographic, clinical symptoms being scarce The direct roentgenogram shows the great rise of the left diaphragm Operation is not indicated

In congenital left hernia from arrest of embryonic development the diaphragmatic dome cannot be localized or is interrupted The stomach is bilocular and little constricted Electric stimulation of the phrenic nerve does not lower the upper limit but accentuates the gastric biloculation The insufflated stomach rises in the thorax, together with the colon Usually the colon is found in the thorax with the stomach Pneumoperitoneum or pneumothorax shows that part of the stomach is below and part above the diaphragm The triangle of Pierre Duval is not present The pulmonary structure can be seen through the gastric chamber Convergent gastric folds are seen in both parts of the stomach The deformity is well tolerated and symptoms are absent or scarce The direct roentgenogram generally shows air in the colon or stomach fusing with the pulmonary structure, this orientates the diagnosis and indicates necessity of studies with opaque substances Exceptionally, there may be symptoms of strangulation which impose operation Seventy five per cent of the patients die in the first

a light dressing applied After remaining in bed for two weeks, the patient is allowed up progressively

Silk is preferred as suture material for this repair

This method of repair of a femoral hernia has been used upon numerous cadavers without difficulty and, when inspected by way of the inguinal canal (Fig 187, 4) is seen to have closed the ring as completely as when repaired from above by the standard method The operation also has been performed on both male and female patients without difficulty Although end results on the patients are not yet available, the immediate results are most gratifying

John W Stretton[5] presents a *needle for repairing femoral hernia* He has used it for years to pass sutures through the ligament of Astley Cooper After the needle is threaded (it will take no 2 silk), its point is first



Fig 188 —Needle half size Bent handle gives clearer view

passed beyond the ligament and then passed through it from the far side The needle point is advanced toward the surface and is then retarded slightly to prevent the silk from lying too tightly against the needle Non toothed dissecting forceps bring the suture to the surface

Diaphragmatic Hernia —Alejandro J Pavlovsky[2] reports a case of *hernia of the esophageal hiatus* (para esophageal variety of Harrington) in a woman, 37, who had undergone left phrenicectomy to replace a useless pneumothorax The pulmonary lesion healed, but the gastric disturbances which had been present for years became aggravated, and diagnosis of hernia through the esophageal hiatus was made five years later She was cured by the classic operation

(5) Brit M J 2 131 Aug 1 194
(6) Semana med 50 813 816 Apr 15 1943

third of the stomach is herniated and clinical symptoms get worse immediate operation is indicated

John W Turner[3] (Springfield, Mass) states that most cases of *gastric herniation at the esophageal hiatus*, or hiatus hernia, occur in well nourished subjects past middle age and are less frequent in males and nullip arous females under 30 Like diverticulosis the hernia may exist without symptoms, but like diverticulitis it may assume great significance in certain cases The occasional difficulty in clinically distinguishing this condition from gallbladder disease, and from coronary disease in particular contributes to its general medical importance The hematemesis and type of pain are often clinically suggestive of cancer but not likely to be confused with peptic ulcer Timely recognition of hiatus herniation may avoid a needless cardiac regimen or unnecessary surgical procedures in patients in whom the diagnosis is least obvious

Thus, the roentgenologist should obtain all possible roentgenoscopic and roentgenographic evidence on each patient who has hiatus herniation for proper evaluation of the significance of this finding The patient should be observed during ingestion of barium in the erect, supine and prone positions Estimation of the degree of gastric constriction which occurs at the hiatus and of the mo bility of the stomach in relation to the hiatus and attention to the rugal pattern in the herniated portion of the stomach are important

A broadly dilated esophageal hiatus with a freely mobile and distensible herniating portion of the stomach and normal rugal pattern is least often connected with symptoms Conversely, a portion of stomach persistently herniated at the hiatus with no mobility, limited dis tensibility and marked prominence of rugal pattern is most likely directly productive of symptoms Large abdominal tumors or large accumulations of ascitic fluid

(3) Am. J Roentgenol 50 33 41 July 1943

year, according to Ladd, who therefore operates during this period and so reduces mortality to 25 per cent

In hernia of the esophageal hiatus (para esophageal variety), the deformity is hard to find if the roentgen examination is not made with this object in view A careful study with opaque substance is necessary to establish diagnosis There is generally hernia of the fundus, which is bilocular The colon is rarely herniated through the hiatus The stomach is better seen in a lateral roentgenogram and must be well filled with opaque substance to show the herniated part It is best to wait a few minutes before taking the roentgenogram The opaque substance falls to the lower part of the stomach, as the cardia is in its normal site, the herniated fundus refills later The situation and aspects of both halves of the diaphragm are normal The herniated gas tric portion is in the posterior mediastinum Clinical symptoms vary in intensity and are progressively aggra vated When the stomach becomes strangulated, ulcera tions may form which accentuate the spasm of the biloc ulation and the clinical symptoms Grave hematemesis complicates these symptoms Surgical intervention is necessary When an exact diagnosis is made, immediate operation which is not difficult is indicated

The surgical importance of the length of the esopha gus is evident Surgical treatment will depend on the symptoms and disturbances of the patient Roentgen findings do not justify an operation Three classes of patients must be considered (1) In those without clini cal symptoms but with roentgen demonstration of small hernias no treatment is needed (2) In those with mod erate symptoms and moderate sized hernias, conservative treatment, regulating diet and reducing weight, is in dicated to improve symptoms (3) In those who do not improve under medical treatment, large hernias with complications are usually found (incarceration and ero sion of the stomach) In all cases in which more than one

At autopsy the abdominal cavity contained much blood stained fluid Lying under the liver were loops of strangulated small intestine which had passed through the foramen of Winslow and then re entered the general abdominal cavity through an opening in the lesser omentum (Fig 189) The site of strangulation was at the opening in the omentum and not at the margin of the foramen The bowel involved was the lower ileum, except the terminal 12 in, and measured 6 ft The proximal portion of the bowel was much distended and congested The stomach was ballooned out and contained a quantity of fluid and undigested food The strangulated portion of bowel could be reduced only with difficulty, but it

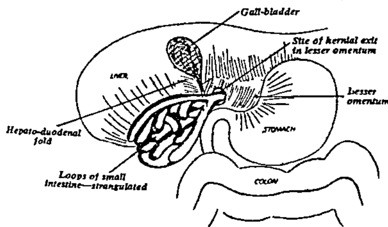


Fig 189

was not necessary to divide the lesser omentum After reduction, the mesentery was seen to be unduly long The foramen of Winslow was dilated, taking two fingers easily, no rounded anterior margin was present, but there was a dense band of fibrous tissue stretching between the gallbladder and the first part of the duodenum this appeared to blend with the lesser omentum The breadth of the band of fibrous tissue from the cystic duct to the free margin measured 4 cm The further opening into the lesser sac was immediately beneath the opening in the lesser omentum The artificial opening in the omentum was 1 5 cm long and 1 25 cm wide

Incisional Hernias Following Gallbladder Operations —Gaston A Carlucci[9] analyzed 412 cases of gallbladder

(9) Am. J Surg 58 9 99 October 1942

or both may cause herniation of the stomach by increase of intra abdominal pressure Hiatus hernia rarely produces dysphagia

Unusual Forms—*Spigelian hernia* is a rare form of ventral hernia occurring through the linea semilunaris, of the anterior abdominal wall Milroy Paul and W C Osman Hill[4] report a case in a girl, 10, in whom a large portion of the abdominal contents passed through a deficiency in the abdominal wall corresponding in position to the right linea semilunaris It would appear that the parietal deficiency was congenital and therefore due to an error during development The error must have occurred early in embryonic life and is to be considered as a failure on the part of a local area of the mesoderm of the body wall to differentiate into its proper proportion of aponeurosis and muscle A region was probably retained in an embryonic state, and this, after the development of a certain degree of intra abdominal pressure, favored the expulsion through it of or the evagination of it by coils of intestine thus producing a hernial sac communicating through the linea semilunaris

Harold Edwards and W Stewart[5] report the fifth instance of *hernia through the foramen of Winslow emerging through the gastrohepatic omentum*

Guardsman, 26, was admitted with dull, aching nonradiating pain in the upper part of the abdomen of eight hours' duration Two hours after onset, he vomited twice the vomit was alimentary without blood, no constipation was present Similar attacks had occurred in the past

Abdominal examination revealed only some tenderness and resistance in the upper part, but the respiratory excursions were maintained A few hours later generalized abdominal rigidity and tenderness set in the liver dulness disappeared, the pulse increased considerably, and the systolic blood pressure dropped to 90 Laparotomy was performed but the patient collapsed on the operating table and attempts at resuscitation failed

(4) Brit J Surg 30 385 397 April 1943
(5) Brit M J 1 343 34 Mar 20 1943

in one case, suppurative pleurisy Some also had other complications cardiac, wound infection, etc Of these, 12 developed hernias (46 per cent) Of 41 whose only complication was wound infection, 11 developed hernias (26 per cent)

No definite conclusion could be drawn concerning the relative value of the incision used in relation to post operative hernia, because so many operations were done through a split rectus incision and so few through the other incisions However, the subcostal and transverse incisions seem to leave the abdominal wall fairly strong and less apt to bulge These two incisions should be used in most subacute or chronic cases

Wound infection apparently just doubles incidence of abdominal hernia in comparison to clean cases The same is true of pulmonary complications, pregnancy does not seem to have a deleterious effect on wound healing

No adequate reason could be found for production of about half the hernias

G Gushue Taylor and Ralph Hayward[7] (Univ of Toronto) report *a case of right duodenal hernia* arising in the mesentericoparietal fossa (Waldeyer), discovered in the dissecting room The sac enclosed the whole of the jejunum and ileum to within 2½ in of the ileo cecal junction Torsion of the duodenum and ileum was present, and this torsion is held to be evidence in favor of the origin of the hernia in accord with views of Moynihan Presence of a direct inguinal hernial open ing and an abnormality in the veins of the leg were noted

A case of *coccygeal hernia* is reported by Jacob M Teske[8] (Durham, N C) in a woman 28, whose coccyx was removed 20 months previously, and the technic is described

Technic —With the patient in the prone position, a mid

(7) Anat. Rec. 83 389 399 July 25 1942
(8) Am. J Surg 58 450 452 December 1942

disease, both acute and chronic, operated on at Bellevue Hospital during the past 20 years and for which accurate follow up records were available for at least one year, but in the majority well over two years If the number of operations is taken as basis (431), the percentage of postoperative hernias is 13 6 The highest incidence of hernias was in the acute openings done through a split rectus incision, the Kammerer and reverse Kammerer incisions in the acute or chronic cases also seemed to leave a weak abdominal wall The 21 per cent incidence of postoperative hernia in the 19 patients who had a cholecystostomy followed later by a cholecystectomy is not unusually high, considering that these patients were quite ill

There were about twice as many women as men with postoperative hernias, but that is about the proportion of sexes found in the group as a whole The youngest patient was 18 and the oldest 77 At least three patients, in whom a definite weakness of the abdominal wall was noted in the first six months, seemed to regain muscular tone and presented no evidence of hernia after three years None of six women who became pregnant shortly after operation developed hernia

Eleven patients had stab wound drainage with complete closure of the original incision, only one an obese patient, developed hernia However, all had chronic cases

There were five cases of disruption, three of which required secondary suture All had other complications but the sickest of all a diabetic who had drainage and two months later removal had a solid abdominal wall 18 months after the second operation Another patient, who had a simple removal, also had a solid wall after 18 months The other three had large hernial defects (60 per cent)

Twenty six patients had pulmonary complications ranging from simple bronchitis to lobar pneumonia and,

disease The third consisted of four patients without jaundice who had primary prothrombin deficiency as sociated with cirrhosis of the liver and ascites

The authors found that prothrombin determination in connection with a therapeutic trial of vitamin K therapy constitutes an accurate means of differentiation between intrahepatic and extrahepatic jaundice But the pro thrombin determination with or without trial vitamin therapy is not qualified as a quantitative test of liver function Serial prothrombin determination over a per iod of time in a patient with hepatic disease may be a suitable index of the progress of the disease

To determine the *influence of hepatic function on vitamin A metabolism,* Karl A Meyer Frederick Steig mann, Hans Popper and William H Walters[6] (North western Univ) compared the concentration of vitamin A in the plasma and in the liver (biopsy specimens) and its fluorescence microscopic distribution in the liver with results of tests of hepatic function and routine histologic picture of the specimens

The plasma level of vitamin A is low when the liver is damaged and is slightly lowered in carcinoma of the stomach If gross nutritional deficiency can be excluded, a plasma vitamin A level of zero points to severe damage to the liver In cirrhosis with jaundice and in obstructive jaundice with hepatic damage, the plasma level is lower and the incidence of zero levels higher than in cirrhosis without jaundice and obstructive jaundice without he patic damage, respectively The hepatic vitamin A con centration is often, but not always reduced when the liver is damaged

The fluorescence microscopic pattern of vitamin A distribution is never completely regular Severe irregu larities however, were found only in cases of hepatitis cirrhosis or obstructive jaundice with secondary hepati tis The milder degrees of disturbances of the micro

(6) Arch Surg 47 643 July 1943

line incision is made directly over the mass through skin and subcutaneous tissue, bringing the posterior aspect of the bowel into view There is usually no peritoneal sac, as the posterior surface of the rectal ampulla forms the protruding mass If the sac is not present the protruding mass may be inverted by *simple plication The posterior part of the levator ani* muscles is freed, and any separation that has occurred in them is sutured The gluteus maximus, with its fascia and sacro tuberous ligament, is freed on each side and firmly sutured in the midline, some sutures in the lower end of the line being made to include the levator ani muscles and thus help to support the anal diaphragm The superficial fascia and skin are closed in layers

From this case and two others found in the litera ture, Tesl e draws the following conclusions Coccygeal hernia is an incisional hernia which occurs only after *surgical removal of the coccyx or severe traumatic* lac eration of the coccygeal region Postoperative wound infection is a definite etiologic factor in formation of this hernia The length of time between removal of the coccyx and occurrence of the hernia has been from seven months to seven years Hernioplasty done by dissection of the important anatomic structures and their approx imation in layers gives a good result

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LIVER

Prothrombin and Hepatic Function —J Garrott Al len and Ormand C Julian[2] (Univ of Chicago) have studied three groups of patients The first included 21 *patients with obstructive jaundice*, 4 with a complete external biliary fistula, 2 with esophageal carcinoma and 1 with gastric ulcer under treatment The last 3 patients had inadequate food intal e and all had prothrombin deficiency The second group included 31 patients with prothrombin deficiency and jaundice due to intrahepatic

( ) Arch Surg 4 691 01 November 194?

disease The third consisted of four patients without jaundice who had primary prothrombin deficiency as sociated with cirrhosis of the liver and ascites

The authors found that prothrombin determination in connection with a therapeutic trial of vitamin K therapy constitutes an accurate means of differentiation between intrahepatic and extrahepatic jaundice But the pro thrombin determination with or without trial vitamin therapy is not qualified as a quantitative test of liver function Serial prothrombin determination over a per iod of time in a patient with hepatic disease may be a suitable index of the progress of the disease

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(6) Arch Surg 47 643 July 1943

scopic picture are considered to indicate slight hepatic damage, not recognized by routine histologic examination The low blood level of vitamin A in hepatitis is a sign of functional deficiency of the vitamin explained by impairment of (1) the release of vitamin A by the liver and (2) the absorption of vitamin A from the intestinal tract The rationale of administration of large doses of vitamin A in hepatic disease is to overcome the impaired intestinal absorption and to saturate the pathologic fat deposits in the liver to impregnate the normal site Fluorescence microscopic changes in the distribution of vitamin A and changes in the periportal field point to functional impairment of the liver in practically all patients coming to operation because of disease of the upper part of the abdomen

Lester M Morrison[7] (Temple Univ) presents a *study of hepatic toxicity with seven currently used anesthetics* in human subjects Liver function was tested by the bile salt concentration in the surgical drainage bile and in the urine

Thirteen groups of selected cases were studied daily postoperatively, following anesthesia by ether, spinal injection, sodium evipan, cyclopropane nitrous oxide rectal avertin and, in obstetric cases, chloroform

In abdominal surgery, in the presence of the normal and pathologic liver spinal anesthesia places a considerably smaller toxic burden on the liver than does ether anesthesia In biliary tract surgery, the rate of recovery of the pathologic and normal livers was considerably more rapid after spinal anesthesia than after ether anesthesia In liver disease the degree of hepatic suppression or insufficiency following spinal anesthesia was much less during the first 11 postoperative days than that following ether anesthesia Sodium evipan cyclopropane and nitrous oxide anesthesia had no discernible postoperative

(7) Rev Gastroenterol 10 171 182 May June 1943

toxic effects on the liver Rectal avertin anesthesia caused postoperative hepatic dysfunction for 24 hours

Chloroform anesthesia as used in obstetrics imposed a postpartum toxic liver dysfunction of 24 hours' duration

In experiments on rats and mice, Myron Prinzmetal, Oscar Hechter, Clara Margoles and George Feigen[8] (Univ of Southern California) demonstrated the presence of a *principle in the liver effective against shock due to burns* This antishock factor was found in some commercial liver extracts and is not identical with the antianemia principle It is not readily destroyed by heat or aeration and is precipitated from aqueous solution by acetone and ethanol

Nine tenths per cent solution of sodium chloride, administered in amounts equivalent to 5 or 10 per cent of the body weight, is definitely effective against burn shock when given after or 30 minutes prior to trauma Pretreatment with liver extract plus large amounts of 0 9 per cent solution of sodium chloride is significantly more effective than salt solution alone

The liver factor described and large volumes of salt solution are the only agents which were found effective in burn shock, adrenocortical hormones, thiamine hydrochloride and other vitamins being without significant action The renal pressor system likewise does not prolong the survival time of animals subjected to burn shock

Naomi Kaplan and Alfred Angrist[9] (Jamaica, N Y) discuss the *mechanism of jaundice in cancer of the pancreas* on the basis of 39 cases in which autopsy was done Jaundice was present in 19 in 13 the cancer originated in the head and in 6 in the body or tail There was carcinomatous invasion of some part of the biliary tract in all cases with jaundice Obstruction by compression alone

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(8) J A M A 122 720 723 June 10 1943
(9) Surg Gynec. & Obst 77 199 204 August, 1943

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(7) Rev Gastroenterol 10 171 182 May-June 1943

the sutured liver is almost imperative because of the necessity of evacuating pockets of blood and bile and providing drainage of the small bile abscesses which form frequently

Pilcher describes a case in which, after an automobile accident, the liver was split almost completely in half vertically

> There was only slight active bleeding from the raw surfaces Three no 2 chromic catgut sutures, introduced and issuing 2 in from the edges of the laceration and penetrating 2 in deep into the liver substance sufficed to close the wound easily and accurately There was practically no oozing A gauze pack was placed up to the dome of the liver and another down to the common duct The right kidney, being extensively lacerated, was removed
>
> The complications which were especially feared (hemorrhage and persistent bile drainage) did not occur but two other complications arose infection and complete disruption of the abdominal incision which was immediately repaired
>
> As the patient had symptoms of obstruction, the abdomen was reopened 4½ weeks after the first operation The obstruction was in the upper jejunum Extensive peritonitis had developed following the second intervention, as a result of which several loops of jejunum had become adherent to the under surface of the incision and to each other These loops were successfully mobilized and jejunostomy was performed The patient is well six months after discharge

The interesting features of this case are that such a massive rupture of liver tissue could be so satisfactorily repaired with only three interrupted no 2 chromic sutures and that there was so little postoperative oozing and such a relatively short period of bile drainage Apparently, when lacerated liver tissue is accurately approximated the ruptured bile sinuses and blood vessels heal rather rapidly The danger of infection when bile sinuses are opened was not sufficiently considered in this case Sulfonamides should have been given from the beginning The danger of using large gauze packs against the liver was again demonstrated There is no

was not encountered Some degree of fixation of the *duct seems necessary for effective obstruction by mechan* ical compression by adjacent tumor

Obstruction leading to the syndrome of painless pro gressive jaundice is most often due to local stenosing annular scirrhous carcinomatous involvement of duct wall Occasionally there is papillary extension into the lumen, in which case sloughing may produce inter mittent or waxing and waning jaundice

This mechanism of jaundice also applies to jaundice in cases of metastases from other foci, when involvement of the extrahepatic ducts or the larger intrahepatic ducts deep in the liver or at the hilus may become the pertinent mechanism

The theoretical basis for cure by resection of the head *of the pancreas in early cases of cancer despite* an ad vanced syndrome of progressive jaundice is implied The known evolution of the syndrome of painless pro gressive jaundice occasionally by stone in the duct is a further indication for early laparotomy in all cases of *persistent* jaundice

Massive Rupture of the Liver—Lewis S Pilcher[3] (Newton, Mass) emphasizes that regardless of the com mon belief, liver lacerations can be sutured simply and satisfactorily Furthermore, although hemorrhage is in variably serious, few patients die of immediate or prim ary hemorrhage, while secondary hemorrhage after suture is rare In view of these facts the mortality from liver injury should not be as high as published statistics indicate

One great temptation in massive wounds of the liver is to insert a large gauze pack and then cease operations The danger of such large packs cannot be overempha sized, moreover, they are usually unnecessary However, a small rubber dam or cigaret drain leading out from

(3) Ann Surg 116 8 7 832 December 194?

of the body surface On admission, sedatives and continuous intravenous saline and glucose were given and the burns were tanned The following day, urine showed 2 + albumin The second day slight icterus developed, which rapidly progressed to deep jaundice, and the liver became palpable The fourth day there was a strongly positive and biphasic van den Bergh reaction (25 units) and nonprotein nitrogen of 78 mg per cent She seemed to improve and by the eighth

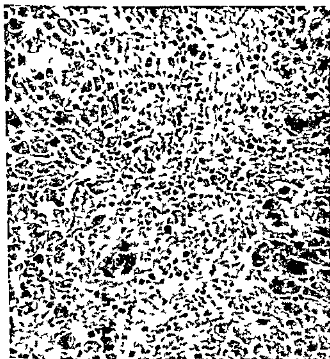


Fig 190 —Necrosis of liver Phloxine methylene blue ×50

day the blood bilirubin had dropped to 16 units and nonprotein nitrogen to normal, while the liver was no longer palpable This day, however, signs of pneumonia developed, and death occurred the tenth day

At autopsy, the liver weighed 1,200 Gm, being perhaps slightly smaller than normal It was flabby, greasy and friable The capsular surface smooth and without wrinkling showed yellowish mottling while the cut surface presented tiny dark reddish areas standing out on a bright yellow background

Microscopically, the liver showed intense central and mid

previously reported instance of recovery of a patient with a massive rupture of the liver complicated by an other serious intra abdominal injury, although several such cases have been reported which ended fatally

[Suture of the omentum to the raw surfaces of the liver is another procedure which is effective in controlling hemorrhage —Ed.]

Liver Necrosis Following Burns —In 1938, Wilson MacGregor and Stewart in Edinburgh reported severe liver necrosis in 13 of 33 patients dying 2 12 days after second and third degree burns In many, jaundice developed as early as the third day and persisted until death Autopsy showed the liver slightly enlarged, soft, greasy and friable Microscopically, focal areas of necrosis involving individual lobules were found, the necrotic areas being central and midzonal with viable liver cells around the portal areas Belt later reported four cases of second and third degree burns with death the third or fourth day, one patient developing jaundice At autopsy the liver lesions were indistinguishable from those of yellow fever The livers were slightly enlarged, greasy and pale yellow Microscopically, there was focal necrosis and varying degrees of fatty degeneration In addition, Councilman's bodies were prominent, and in tranuclear inclusions were demonstrated This combina tion of focal necrosis Councilman's bodies and intra nuclear inclusions had hitherto been described only in yellow fever and Rift Valley fever, both virus diseases

Evidence of impairment of liver function in patients recovering from burns was recently presented by Wolff, Elkinton and Rhoads, who found that between 3 and 10 days after the burn there were elevation of blood bilirubin, impairment of glycogenesis and hippuric acid synthesis and lowered blood prothrombin level

John D Duffin[4] (Toronto) reports a case

Woman, 33 had second and third degree burns of the face neck, shoulders, arms and hands, covering about one twelfth

(4) Canad M A J 47 138 139 August 194

The liver lesions were indistinguishable from those of Belt's cases (Fig 191) and from the lesions seen in the livers collected by Klotz from a large series of human beings and monkeys dying of yellow fever Liver changes in Rift Valley fever are similar to those of yellow fever, and many features of Daubney and Hudson's and also Findlay's descriptions of these changes might equally well have been applied to Belt's and Duffin's burn cases The finding of intranuclear inclusions following burns supports the concept that inclusions of this type may be produced by a multiplicity of agents, of which viruses form only one group

The actual cause of liver necrosis in cases of burns is obscure, but it is difficult to conceive of its being due to anything other than a circulating toxin, elaborated either in the burned tissue or elsewhere as a result of presence of burned tissue The exact nature of this agent is undetermined

J M Berkman and J A Bargen[5] report a case of *amebic abscess of the liver with choledochal and external fistulas*

Physician 42 contracted amebic dysentery in 1925 and had attacks of bloody diarrhea every five or six months until 1932 The attacks were always brought under complete control by carbarsone 20 capsules over a period of 10 days From 1932 until April 1941, he had no diarrhea and no blood or unusual mucus in his stools However he had noted that eating laxative food such as prunes, might be followed by three or four watery stools Toward the end of 1940 he began to tire easily and temperature daily was over 101 F He had night sweats and two or three loose but nonbloody stools daily Leukocyte count was 10,000 and in four days rose to 19 000, with 55 per cent lymphocytes and 1 7 per cent eosinophils Several stools were examined but Endamoeba histolytica was not found Retrocecal appendix was suspected and appendectomy performed Microscopic examination of the appendix for Endamoeba histolytica and tuberculosis was negative Ten days after operation temperature varied between nor

(5) Proc Staff Meet Mayo Clin 17 481 487 Sept 9 194

zonal necrosis (Fig 190) At the periphery of the lobules was considerable interstitial edema and the liver cells, though viable, exhibited loss of uniform arrangement and fatty degeneration, while the peripheral canaliculi of many of the cords were filled with green brown bile casts The picture differed from that of acute yellow atrophy in that necrosis affected portions of the individual lobule and not the whole of several adjacent lobules Throughout the liver, numerous fading out and some well preserved Councilman bodies were visible These took the form of vacuolated, hyaline like structures, made up of altered cytoplasm of one or more cells, and in some instances within the cytoplasm of individual cell Occasional rounded brightly eosinophilic, intranuclear bodies, of the group classed by Cowdry as type A inclusions were seen These varied from 3 to 7 microns were usually centrally situated in the nucleus and were surrounded by a clear halo of variable thickness There was little polymorphonuclear leukocytic response to the necrosis

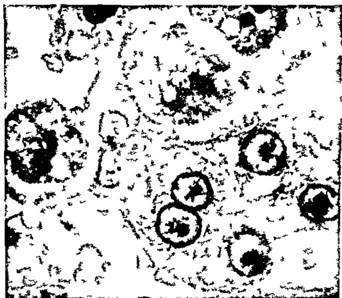


Fig 191 —Fi e nu l i c ntaining inclusions are s en in right lower quadrant with Councilman bod es above and t left (Belt s case 1) Hematoxylin eosin X1 ?50

Death was due to liver necrosis staphylococcic pneumonia and pyemia

which responded each time to treatment with emetine hydro chloride Five weeks prior to his second visit, temperature, which had been 103 F, returned to normal after administration of 5 gr emetine hydrochloride subcutaneously When seen at the Clinic he was still taking 2 gr bismuth emetine iodine daily and continued fever free Total dosage of emetine hydro



Fig 192 —Amebic abscess of liver with choledochal and external fistulas

chloride administered in the past five weeks was 26 gr, which brought total dosage to 120 gr He looked much better Sedimentation rate was 50 mm the first hour

It was felt that further drainage of the abscess with instillations of antiamebic preparations directly into the abscess would entail less danger than further emetine hydrochloride

mal and 100 F, and, although the liver could not be felt tenderness was noted in the upper right quadrant just below the costal margin He was given 1 gr emetine hydrochloride daily for 12 days, and temperature returned to normal Stools were beginning to assume form and, although he had lost 40 lb during this illness, he seemed to show considerable im provement After he had been up for a few days, temperature rose to 101 5 F, and he took another 12 day course of emetine and the temperature returned to normal However, the same course of events took place the following month and, until ad mission, fever had been 101 5 F daily In 1926 and from 1940 to the time of admission he had taken 44 gr emetine hydrochloride and large amounts of acetarsone and carbarsone

The first few days after admission, temperature rose to 101 5 and occasionally 102 F in the afternoon, but was normal or nearly normal in the morning Results of routine laboratory tests were essentially negative or within normal limits Sedi mentation rates on two occasions were 108 and 119 mm the first hour The bromsulfalein test of liver function revealed retention of dye, grade 2 Because of lack of significant find ings and because the course was downhill, abdominal explora tion seemed warranted Preoperatively, 6 gr emetine hydro chloride was given over three days and 4 gr chiniofon three times a day four days

May 20, 1941, right rectus incision was made Exploration of the lower part of the abdomen was negative Exploration of the undersurface of the liver disclosed a portion which was more prominent than the surrounding surface The most de pendent portion of the prominent part of the right lobe was aspirated beneath the attachment of the suspensory ligament and 1,200 1,500 cc thick, yellowish, odorless pus was removed Cultures made from the pus were sterile The thirteenth day, drainage was slightly blood tinged, and for the first time Endamoeba histolytica was found in the pus, 4 gr emetine hydrochloride was given, followed by 12 tablets of treparsol in four days The antiamebic treatment given pre and post operatively did not affect the fever or general condition Al though at first the postoperative course was somewhat stormy, the patient made reasonable progress

October 24, he returned for observation After returning home he had instilled 1 gr emetine hydrochloride into the draining sinus, immediately followed by chill and fever of 106 F which lasted 24 hours Following this, fever disappeared, he gained 35 lb and had general well being which lasted five weeks This was followed however, by further attacks of fever

curred An abscess of the liver developed in the other case also, with rupture to make a subdiaphragmatic abscess, rupture of this abscess into the pleural cavity and then into the lung Bronchial fistula resulted so that he was expectorating large amounts of bloody pus

Amebas destroy tissue by lysis, after such destruction of tissue, invasion by innumerable bacteria follows and large infected cavities result Two types of hepatic abscess occur a large solitary abscess or multiple small abscesses, so called diffuse hepatitis Occasionally, extensive skin lesions have been known to occur near a draining amebic sinus

The case reported illustrates many interesting features A rather characteristic roentgen feature is the so called coning of the cecum Involvement of the intestine by ameba is of the cecum and colon distal to it, the lesions stop abruptly at the ileocecal valve and hence the cecum "cones down" to a narrow tube, whereas in tuberculosis the ileocecal valve is involved This patient's recurring fever is of particular interest Amebic infection was suspected preoperatively but could not be proved The other interesting fact is the length of time 17 years, that this physician apparently had harbored the ameba At times infection was dormant The most important feature is the amount of antiamebic therapy that one individual can tolerate Logan and Pollock showed that the average person could safely take 20 gr emetine by mouth if it were given in courses of say 4 to 6 gr, ⅔ gr twice a day for four to six days, followed by a rest of a week and then a second course If emetine is given in this careful way symptoms of poisoning do not develop But this patient took much more emetine than ordinarily is safe

[It is well for American surgeons to become familiar with amebic infection for doubtless with the return of our armed forces from the tropic many cases with all of the various complications will appear —Ed]

subcutaneously He returned early in January, 1942, for further surgical drainage of the liver abscess During the interim he had taken 17 gr emetine hydrochloride in three courses, bringing total dosage to 137 gr After each course, temperature had returned to normal

At operation on January 9, the bulging over the amebic abscess had disappeared A large aspirating needle was introduced through the scar of the previous opening for 2 5 cm and blood streaked, creamy white pus was obtained With the cutting cautery, an opening 2 in long was made into a cavity about the size of a baseball Several drainage tubes were left in the cavity For eight days 1 gr emetine was instilled each morning into the cavity, in the afternoon it was irrigated with a 2 per cent solution of chiniofon, For four days, 4 gr chiniofon was also given by mouth This was followed by a course of 3 capsules of carbarsone daily for four days Later 4 gr chiniofon was given daily for seven days After the first three postoperative days, temperature was normal except on three occasions when it was 100 F or less He was discharged January 13

From then until two weeks before he returned April 21, no antiamebic treatment was given Drainage from the sinus increased and became profuse Twice he noted the drainage was bile tinged He was given 7 gr emetine in four days, and this lessened the drainage On his return, a smear from the draining sinus showed Endamoeba histolytica A roentgenogram of the sinus tract following injection of an opaque medium revealed a direct connection from the abscess cavity to the common bile duct and thence to the intestine (Fig 192) In view of the amount of antiamebic treatment that had been used and been ineffective it was decided that treatment must be intensive regardless of risk From then to August 1942, the following amounts were given 30 gr emetine subcutaneously 18 gr emetine instilled into the sinus 20 capsules of carbarsone diodoquin for 10 days, chiniofon in a 2 per cent solution as lavage and chaparro amargoso infusion as lavage Drainage became thin and watery All material used in lavage returned externally He had difficulty keeping the sinus tract open and did so only with an inlying catheter Finally on July 7, the tract closed Up to then, over 194 gr emetine had been administered

Complications of infection by Endamoeba histolytica are many severe and varied This is one of two cases followed recently in which serious complications have oc

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[It is well for American surgeons to become familiar with amebic infection for doubtless with the return of our armed forces from the tropic many cases with all of the various complications will appear —Ed.]

Actinomycotic Abscesses of Liver and Lungs—Roland T Smith[1] (Des Moines, Ia) describes a case found at autopsy after a 5½ month stormy convalescent period following surgical closure of a ruptured gastric ulcer

Five weeks after operation, the patient left the hospital against advice He returned in one month with pain and tenderness in the right upper quadrant which was controlled so well under ulcer management that he left the hospital in one week He returned three weeks later with a stitch abscess The abscess was drained and the patient seemed to make some improvement for one week, but from then on he gradually lost ground, and in three weeks signs and symptoms of liver abscess developed

After several transfusions and general supportive measures laparotomy was performed and the sinus tract explored It extended from the old operative closure of the stomach to the anterior surface of the liver over the omentum, which, at the previous operation, had been sutured to the stomach at the site of the ulcer It is interesting that the site of closure of the stomach allowed no escape of gastric contents The tract continued over the anterior and superior surface of the liver to the dome and from there had burrowed along the thoracic wall, finally coming to the surface through the rectus muscle and skin just below the costal margin No abscess could be found The wound was closed with drainage and continued to drain thick, greenish yellow exudate for seven weeks until the patient died Smears from the pus, liver contents and sputum and the blood culture were negative for actinomycosis or any other pathogen

Diagnosis of actinomycosis of the lungs and liver was made from sections of tissue obtained at autopsy Both lungs contained numerous small abscesses measuring 1 3 cm in diameter, containing green pus The liver was filled with abscesses varying from 2 to 6 cm in diameter, containing a thick, greenish foul purulent material These abscesses appeared more or less in clusters in the liver and seemed to be loculations of one continuous system This arrangement was not so definite in the lungs A few areas of the liver were soft and necrotic

Mortality rate of actinomycosis of the liver is 80 100 per cent and most authors fear that 100 per cent is

(1) Am J Surg 60 438 44 June 1943

more correct In actinomycosis of the lungs alone, the mortality rate is about 70 per cent Treatment is unsatisfactory, iodides, thymol, roentgen rays and radium have been used

Clifford D Benson and Grover C Penberthy[8] (Detroit) report complete excision of a *primary encapsulated tumor of the liver (hamartoma)* in an infant, 7 months, with recovery Recognition of tumors of the liver in infants is important. All such patients deserve exploratory laparotomy because, despite the fact that liver tumors in infants carry a poor prognosis, occasionally a benign tumor, such as the one described, will be found Complete surgical removal offers a good prognosis Hamartoma tumor of the liver can be considered benign because (1) it is well encapsulated and has embryonal characteristics, (2) it shows no tendency to invade neighboring tissue, (3) on microscopic examination no mitotic figures are found, (4) metastases do not occur, and (5) symptoms arise only from progressive growth of the tumor, with subsequent displacement of neighboring structures

W Wayne Babcock[9] (Temple Univ) reports successful suture of a portal vein incised in the liver, made possible by temporary clamping of the portal vein and hepatic artery Five cases of suture or surgical occlusion of wounds of the portal vein were found in the literature He describes a practical and simple method for *temporary occlusion of the portal vein and hepatic artery* which he used in amputation of the left lobe of the liver for extensive primary carcinoma

TECHNIC—Temporary occlusion is obtained by use of a tape and a section of soft rubber catheter or other fairly stiff rubber tube, as suggested by Mason Astley (Fig 193) The tape, wet with saline, is carried around the vessel and the ends are pulled through the rubber tubing with a wire loop or

(8) Surgery 12 881 886 December 194*
(9) Ann Surg 116 833 84* December 194

fenestrated probe With traction on the ends of the tape the end of the rubber tube, which may be rolled back, is pushed against the vessel firmly enough to arrest circulation when the distal end of the tube with its contained tape is clamped with a hemostatic forceps The rubber tube may be long enough to hang from the wound, out of the way, and the relatively soft compression of the tape may be released or tightened instantly, as desired

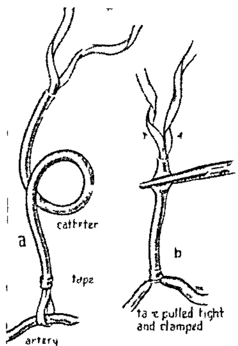


Fig 193 —Simple device for temporary occlusion of large blood vessels Rubber tube may be of sufficient length to be clamped outside wound (Babcock above)

External Hepatostomy —W Wayne Babcock[7] (Temple Univ) presents a case in which the edge of the liver was exteriorized on the surface of the abdomen for about five months without unfavorable reaction The liver gradually *became covered by a* film of squamous epithelium derived from adjacent skin From a minute duct opened on the edge of the liver, sufficient bile drained to relieve jaundice and its symptoms With closure by epithelization of open bile ducts it was possible to obtain additional adequate drainage painlessly and without unfavorable reaction by incision or wedge shaped resection of the exposed liver

Hepatostomy of the exteriorized liver is suggested as a palliative operation to relieve intense jaundice and

(7) Surgery 1 9? 9 8 December 1942

associated symptoms of ineradicable malignant disease when other palliative measures are ineffective Hepatostomy with or without exteriorization is suggested as a possible first stage procedure for congenital absence or occlusion of the extrahepatic biliary ducts when a single stage anastomosis to the gastro intestinal tract is unduly hazardous

[The editor has had no experience with external hepatostomy in man but he has found it to be a well tolerated procedure in experimental animals —Ed]

Omentopexy for Cirrhosis—Horace B Cates[9] states that data from Los Angeles County Hospital show prognosis for cirrhosis is usually poor Omentopexy performed on selected patients has not prolonged life Of 117 patients not treated surgically, 72 per cent had died within one year after onset of symptoms Fifty three of this group had ascites and, in addition, had survived one month after the onset of symptoms, they were treated medically, and 38 per cent of them lived over one year

Of 38 patients on whom omentopexy was performed for relief and cure of ascites, 16 (42 per cent) died within two weeks after operation Follow up of the remaining patients shows that prognosis is no more satisfactory than if medical treatment alone had been given

In the light of the present concept of formation of ascites, the surgical concept that restoration of collateral circulation from the portal system is possible by mechanical means is false Only with sustained elevation of the vascular osmotic pressure will ascites subside, and this unfortunately is not as easily achieved in the patient with cirrhosis as in one who has edema and ascites associated with degenerative nephritis or nephrosis

The hypoproteinemia of cirrhosis causes important physiologic alterations, all of which are inimical to surgical intervention The patient is more susceptible to

(9) Arch Int Med 71 183 0 February 1943

shock, restoration of fluids subsequent to operation is fraught with serious risk, wound healing is impaired, and proper administration of any anesthetic is associated with greater than average danger

Enterectomy for ascites due to liver cirrhosis was first reported in 1937 by Fuller and collaborators It consisted of resection of the first part of the jejunum (about 80 in) The method is based on the following considerations (1) As the ascites is principally due to obstruction of portal circulation in the liver, elimination of part of the portal network by ample resection of the small intestine should reduce the venous blood to an amount that can pass through the cirrhotic liver, thereby decreasing pressure in portal vein and capillaries, and consequently transudation of fluid (2) Shortening of the small intestine without change in the amount of food and liquids which pass through it should increase osmotic pressure of the intestinal contents and attract fluid into the intestinal lumen, increasing volume of the feces (this explains the diarrhea which occurs after massive resection of the small intestine) (3) Stasis in the portal system produces some anoxemia which increases permeability of the membranes for transudation of fluid, this would be stopped by re establishing normal pressure in the portal system (4) Elimination of a considerable portion of the small intestine changes the relations between visceral and parietal peritoneum Admitting that ascitic fluid passes through the visceral peritoneum and is absorbed by the parietal peritoneum, the resection will relatively increase the absorbing surface

However, M Huergo U Castellanos and A Nuñez[1] (Calixto Garcia Hosp) thinks that the effect of the operation is purely mechanical on the circulation through reduction of the portal venous network, of the afflux of arterial blood and of the pressure in the portal system If it were possible to ligate the upper mesenteric

(1) Rev de med y c Habana 47 416 421 30 194

artery, the result would be the same as that obtained by enterectomy, the blood volume reaching the portal vein would be smaller and capable of passing through the cirrhotic liver As they believe gravity influences transudation of the fluid they prefer resection of the distal part of the ileum They describe a case of ascites due to liver cirrhosis in a man, 65 Under local anesthesia, they resected 2 08 M ileum, starting about 20 cm from the ileocecal valve and finishing with an end to end anastomosis Fourteen months later there had been no fluid in the abdominal cavity This compares favorably with Fuller's case in which it took nine months for fluid to disappear completely The patient's general condition improved considerably and weight increased 30 lb

[Splenectomy has often been proposed for the same purpose in order to remove the volume of blood passing through the portal vein The difficulty with the operation however in cases of cirrhosis of the liver often is that adhesions around the spleen are so numerous and troublesome that splenectomy is impossible with any reasonable safety—Ed.]

GALLBLADDER AND BILE DUCTS

Cholecystitis—Dean Macdonald[2] (Ontario, Canada) finds that the present criteria for determining the type and timing of the *treatment of acute cholecystitis* do not seem to be pathologically sound For instance the time element is too variable, the type of operation is not constant, the influence of anesthesia is rarely mentioned, the individual constitutional stability of patients cannot be evaluated in large groups, and the condition is often considered as a disease entity, whereas it is really a symptom and a sign of a serious abdominal condition, namely, an acute obstruction The potential seriousness of all obstructive lesions is well recognized, they demand active and early treatment There is also failure to con

(2) Arch Surg 47 20 25 July 1943

sider this condition as positive evidence of progressing pathologic change of the biliary system and to remember that the clinical picture is not always correlated to the active pathologic process Therefore, a two stage surgical procedure is suggested as a new method of treatment in certain cases, particularly when the lesion is in an early stage, it is based on the etiologic factors and the resultant pathologic state The first stage consists of cholecystostomy, which is preventive and the second of cholecystectomy plus a ductal operation, which is curative The two stage operation has lowered the mortality of many surgical conditions and operations The same basic principles deserve serious consideration in connection with certain types of biliary disease

The theoretical and practical advantages of the two stage procedure are given (1) In cases of acute cholecystitis (*a*) it prevents the serious or the potentially fatal complications of conservative treatment (*b*) it averts pericholecystic pathologic changes (fistula formation) which make trauma a serious factor at later operations and may make curative surgery possible only in the hands of the most experienced, (*c*) cholangiography may often be of great help before the second stage, (*d*) cholecystectomy and surgical treatment of the common duct (which is so often a part of successful surgical treatment of the gallbladder) can be performed with much more thoroughness and safety in a quiescent stage than during the acute active phase, (*e*) it obviates dangers related to removal during the acute stage, not the least of which is traumatic stricture of the common duct, and (*f*) it predisposes to the return of a normal physiochemical balance and general improvement in the physical status before extensive surgical intervention is done (2) In cases of obstructive jaundice, (*a*) the serious and always potentially dangerous surgical work is performed on a patient who presents a much safer risk

at the second stage, in the absence of jaundice and in the presence of improved biliary and hepatic function, (b) cholangiography may be a definite help in the second stage in that the presence and location of ductal stones can be determined, (c) perfusion will have helped to improve the blood and lymph circulation and to remove infection throughout the biliary system, (d) decompression of the liver is much more gradual and less dangerous when carried out slowly through the gall bladder, and (e) the morale of the patient is improved tremendously after the first stage, when jaundice is reduced and symptoms subside This cannot be stressed too much

[It is hard to under tand why the author speaks of this as a new method of treatment It has been u ed in selected cases by many surgeons for many years It is undoubtedly a useful procedure and one which is often life saving —Ed]

Acute Cholecystitis and Its Rational Management —In literature of the past few years on acute cholecystitis, there is much difference of opinion regarding treatment While all surgeons agree that ultimate cure lies in operation, many advise immediate or early intervention to avert gangrene, perforation and peritonitis, and others, equally experienced, recommend delayed operation on the grounds that under conservative management symptoms will often subside and so make operation possible during a quiescent period with less risk to the patient

James H Saint[2] (Sansum Clinic Santa Barbara, Calif) finds that the cause of this confusion lies in failure to apply the fundamental surgical principle that the basis of rational treatment of any condition is a thorough knowledge of the underlying pathology and its correlation with the symptomatology In place of this rational approach to the problem of "when to operate" it has unfortunately become the custom to attempt its solution in terms of the time factor, disregarding the

( ) Surg Gyn c & Obst 3 3 S ptember 194?

fact that rate of progression of the pathologic changes varies in each case and thus can never bear a fixed relationship to the time factor

While the pathologic changes which occur in the gall bladder result from two factors, namely, acute obstruction of its outlet and acute inflammation of its wall, the rôle played by the former is of such importance as to suggest the desirability of designating the disease "acute obstructive cholecystitis" The essential pathologic fea

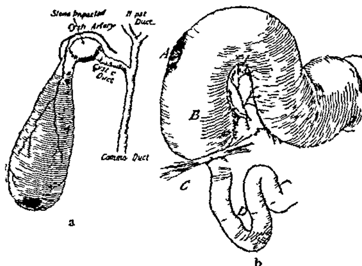


Fig 194 —Tension gangrene in hollow muscular viscera essential presence of obstruction of lumen an etiologic factor *a* Gallbladder with tension gangrene *b* Acute intestinal obstruction of two days duration *A* gangrenous patch *B* small intestine distended *C* constricting band *D* collapsed intestine *F* mesenteric vessels.

ture is an increase in the intravisceral tension in the gallbladder, as the result of this combination of acute obstruction and inflammation This tension may become so acute as to interfere with the blood supply and cause gangrene of the gallbladder (tension gangrene), followed by rupture and extravasation of its contents Figures 194 and 195 illustrate examples of tension gangrene in various hollow muscular viscera and show its

importance in surgery, also the possibility of its occurrence not only in the gallbladder but in any of the hollow muscular systems of the body

Rational treatment aims at prevention of gangrene and thus of possible complications of rupture and extravasation, by relieving the increased intravisceral tension *by surgical intervention should the disease progress* to the stage when it has become apparent that nature is unlikely to succeed in her efforts to remove or overcome the obstruction Relief of tension may be ac

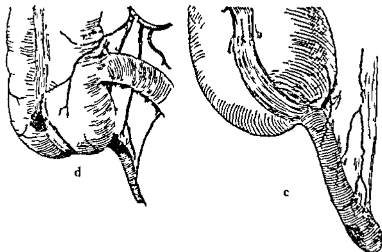


Fig 195 —Tension gangrene *d* Tension gangrene in cecum following obstruction due to cancer of sigmoid *c* Appendix with tension gangrene.

complished by drainage of the gallbladder or by its removal, the type of procedure being decided at operation rather than by routine with consideration of such factors as the patient's general condition, the local findings at operation and the surgeon's ability and skill

The most important single clinical manifestation indicating that the disease has progressed to the stage in which immediate relief of the increased intravisceral tension is needed to prevent further progression of the pathologic changes to the termination of tension gan

grene is development of a tender, palpable mass in the right upper quadrant If noted early in its development, this mass will present the typical characters of a distended gallbladder as regards shape, definition, dulness on percussion and relations Later, with extension of the inflammation to the visceral peritoneum, the gallbladder usually becomes buried in omentum (this structure acting in its capacity of abdominal policeman and as such endeavoring to exclude the source of mischief from the general peritoneal cavity) and the mass, while retaining the gallbladder relations loses the shape and definition of the free organ and tends to become more fixed

Should such a gallbladder be examined it will be found to present an appearance markedly different from that of the normal viscus (Figs 197 and 198) It is enlarged the increase being partly due to thickening of the wall by edema but mostly due to distention beyond its normal capacity by the increased volume of its fluid contents which may vary from dark appearing bile to frank pus In the early stages the wall is of a reddish hue and later becomes a plum blue color, resembling that of strangulated bowel while later the black or gray color characteristic of gangrene makes its appearance beginning at the fundus The gallbladder is tense in contra distinction to the comparative laxity of the normal, though distended gallbladder If a small incision is made in the fundus the contents will be expelled forcibly, indicating the increased tension, in marked contrast to the nonexpulsive even flow of bile that occurs from a distended normal gallbladder similarly opened It is obvious that the gallbladder could become tensely distended in such a manner only in the presence of an obstruction of its outlet To hope that spontaneous recovery will take place, once this stage has been reached is wishful thinking, and if the increased intravisceral tension is not relieved by surgical intervention progression with its serious terminations is much more likely to occur Thus,

this stage of acute cholecystitis is of crucial significance, since it constitutes a clear indication for operation as soon as possible

Development of rigidity of the musculature in the region of the gallbladder is a physical sign of considerable importance, since it represents the reaction of the abdominal wall to irritation of the parietal peritoneum A



Fig 196 —Gallbladder in case of acute obstructive cholecystitis showing gangrene of mucosa Contents consisted of purulent foul smelling bile under great tension Escherichia coli and a nonhemolytic streptococcus were cultured from both bile and gallbladder wall and microscopic examination of the latter showed marked acute inflammatory change Wall was relatively thin at the fundus and a patch of gangrene would soon have appeared in this region A small stone was impacted at the outlet Onset of symptoms 48 hours before operation.

continuous increase in pulse rate is frequent and one of the most certain indications of a progressive pathology The behavior of the temperature is unreliable as a guide to the general or local condition of the patient or to the optimal time for operation The total and differential

leukocyte counts are more reliable, since they tally fairly closely with the clinical progress of the case

Since 1930 Saint has operated in 44 cases of acute cholecystitis This series, though small in comparison with those emanating from hospitals, has the advantage of representing the experience of a single surgeon in that his opinion alone was responsible for advising the operations, which were all performed by him In each case the chief indication for operation was the finding of a tender, palpable mass in the right upper abdominal quadrant This sign was present in 28 patients when they were first seen, and immediate operation was advised and undertaken The remaining 16 patients had been under observation from a number of hours up to eight days before the sign became manifest, and only then was immediate operation advised and undertaken It is emphasized, therefore, that the decision of "when to operate" was not in any way related to any belief or general rule regarding advisability of respective "immediate," "early" or "delayed" operation as such, but was based entirely on the development of what are considered specific indications for operative intervention, the chief among these being the finding of a tender, palpable gallbladder, while other signs, such as a spreading rigidity of the overlying muscles and an increasing pulse rate were usual accompaniments furnishing confirmatory evidence of the progressive nature of the pathologic process

The only death occurred in the last case of the series following cholecystectomy, so that in 43 consecutive cases patients were operated on without a fatality This fact is of importance if for no other reason than proving the fallacy of the statement often encountered that operation in the acute stage of acute cholecystitis is likely to be associated with a forbidding mortality rate

Gangrene of the whole thickness of the wall had occurred in 5 of the 28 patients who had a mass when

first seen In one of them perforation had occurred, but the envelopment of the gallbladder by the omentum had prevented soiling of the general peritoneal cavity No instance of gangrene of the whole thickness of the wall occurred among the patients who developed a palpable mass while under observation, but in several instances



Fig 197 —Exposure of gallbladder region through a Kocher incision (inset) in acute obstructive cholecystitis characteristic appearance of omentum enveloping the gallbladder and thus shutting it off from the general peritoneal cavity (From photograph taken at operation)

gangrene of the mucosa alone was found to have taken place (Fig 196)

The frequency with which stones are the cause of obstruction in acute cholecystitis is well exemplified in the present series, as they were responsible for its occurrence in 40 or 91 per cent of the cases

Cholecystostomy was performed in 32 cases and cholecystectomy in the remaining 12, the preponderance of cholecystostomies being due to the fact that they largely

represent the author's earlier operative experience After an attack of acute cholecystitis, the gallbladder will only resume reasonably good function in a minority of cases, when the patient's general condition is good and the local findings are such that cholecystectomy can be performed satisfactorily, this is the operation of choice

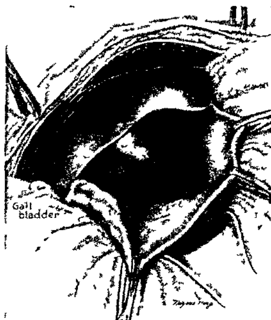


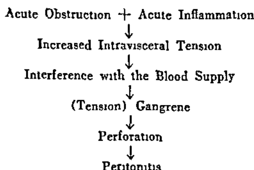
Fig 198 —Same case as preceding Omentum peeled off gallbladder which is grossly enlarged tensely distended and has dark thickened wall Content consisted of nonpurulent bilious fluid under great tension Microscopic examination of wall showed only minor acute inflammatory changes no *stones* Fundal mucosa gangrenous 36 hours after onset of symptoms (From photograph taken at operation)

Saint has no means of knowing the number of patients with a provisional diagnosis of acute cholecystitis who have been under his care and who recovered without operation, but they certainly exceed those on whom operation was performed In no case in which, after his first clinical examination he decided on observation did a fatality occur The patients either recovered under the conservative measures instituted or progressed to the stage in which a tender, palpable mass developed and

immediate operation was undertaken successfully Thus, the patients who recovered without operation, and who formed the majority of those observed, consisted only of those who never progressed to this stage, indicating that until this stage is reached the possibility of recovery is sufficiently great to warrant the adoption of conservative treatment, unless one is dealing with the exceptional case in which, despite failure to detect a palpable mass, other clinical manifestations indicate a progressive pathologic condition Saint therefore considers that to insist that every patient should be operated on as an emergency is just as erroneous as to declare that all patients should be treated by the "delayed" plan

James H Saint[3] (Santa Barbara, Calif) discusses *acute obstructive cholecystitis and the application of the principles of its rational treatment* In any case of this disease operation will be necessary sooner or later if ultimate cure is to be achieved Consequently, the important question is when to operate The ability to recognize the indications for intervention depends on knowledge of the pathology and its resulting symptoms allowing interpretation of the latter in terms of the former Treatment based on this knowledge is the only logical or rational procedure

The simple, but ill understood pathology is represented by the following synopsis



(3) Surg Gynec. & Obst 77 260 260 September 1943

Thus, the outcome will depend on whether or not the increased tension within the gallbladder is relieved. If left to nature, it may be relieved in one of two ways: (1) the obstruction is overcome, and the contents escape by the natural route, in which case the patient recovers spontaneously and elective surgery can be performed later; (2) the contents escape through rupture of the gallbladder after gangrene has occurred. The obvious procedure is to intervene before this catastrophe has taken place. Clinical recognition of this stage is therefore of crucial importance.

This stage is characterized by development of a tender, palpable mass in the right upper abdominal quadrant. If noted early, this mass will present the typical characteristics of a distended gallbladder. Later, with extension of the inflammation to the visceral peritoneum, the gallbladder usually becomes buried in omentum, and the mass, while retaining the gallbladder relations, becomes more easily detectable because of the increase in its size but loses the shape and definition of the free gallbladder and tends to become more fixed. Other important manifestations indicating progressive pathology are continuously increasing pulse rate, spreading rigidity of the abdominal muscles in the gallbladder region and deterioration of the patient's general condition.

Saint describes two representative cases managed in accordance with these principles.

CASE 1.—The first patient was seen early in an acute attack of biliary colic without abnormal physical findings. The prognosis, therefore, depended on whether the obstruction would be relieved, as it had been on previous occasions, or whether it would persist with the possible development of acute obstructive cholecystitis. That the pathology was progressive became evident the next morning when tenderness and rigidity were found. These new developments, together with the persistence of the biliary colic, justified the provisional diagnosis of early acute obstructive cholecystitis, but there was no indication for operation as an emergency measure, for at

this early stage the chances that the obstruction will be relieved ordinarily exceed those that it will persist

The presence of a questionable mass at this time pointed to the possibility of distention of the gallbladder and to the probability that a definite mass would appear sooner or later This probability became a certainty within a few hours, showing the rapidly progressive nature of the pathologic process The gallbladder had become tensely distended and enlarged much beyond its size at the beginning of the attack, when it was not palpable The only possible explanation was a combination of obstruction and inflammation resulting in tension acutely increased to a dangerous degree Consequently, the patient was advised that the time for operation had come The continuous increase in the pulse rate and the other clinical features confirming the behavior of the pulse were further indications that the condition was steadily becoming worse

The findings at operation were a grossly enlarged and tensely distended gallbladder, thick walled, plum blue and enveloped by an inflamed and matted omentum The cystic duct was stenosed to such a degree that a fine probe could be inserted into it only with difficulty Pathologic examination of the gallbladder revealed gangrene of the fundal mucosa

Here is a case of such severity that obvious interference with the blood supply occurred within 24 hours, and yet no stones were present Moreover, the pathologic condition of the gallbladder provided ample evidence that the clinical manifestations, on which the decision to operate was made, had been interpreted correctly as indicating the advisability of immediate operation

While Saint considers cholecystectomy preferable relief can be obtained by cholecystostomy, and this comparatively simple operation is recommended to any inexperienced surgeon into whose hands one of these patients should chance to fall

Case 2—Indications for operation did not develop during the attack and operation was done later

When the provisional diagnosis of acute obstructive cholecystitis was made on the history of biliary colic and the physical signs of tenderness and rigidity over the gallbladder region, together with some increase in the pulse rate and temperature the patient was sent to hospital for further observation The white cell count was higher than in Case 1,

although clinically the patient was not nearly so ill Later during the day of admission, when the temperature and pulse rate increased, any temporary progression of the pathologic changes which these findings might have represented was not confirmed by clinical examination, as the tenderness and rigidity were less marked and the pain had diminished Absence of a palpable mass led to the conclusion that even if the lesion was progressive it had not reached the stage when immediate operation was necessary The following morning all signs and symptoms showed improvement, unmistakably pointing to regression of the pathologic changes This favorable course continued, and the patient soon became completely free from symptoms

The essential difference between the two cases is that in the first the obstruction persisted, while in the second it was relieved early by natural means Too much emphasis cannot be laid on the fact that in this disease the significance of a palpable mass remains unaltered no matter to what extent apparent lack of confirmation by other signs and symptoms may seem to deny its import

Kenneth M Lewis and Charles W Peterson[3] (Bellevue Hosp, New York City) report 25 cases of *cholesterosis of the gallbladder without stones* treated by cholecystectomy Pain was a predominant symptom and 19 patients complained of recurrent, typical biliary colic in the upper abdomen Cholecystograms were inconclusive, only five cases showing nonvisualization of the gallbladder Preoperative diagnostic biliary drainage revealed cholesterol crystals in the bile in 19 cases This procedure is urged as a diagnostic aid in this disease, where frequently the signs, symptoms and roentgen findings may be indefinite Cholecystectomy gave satisfactory results Of the 20 patients followed 1 10 years, 14 were relieved of all symptoms, 4 were relieved as long as they stayed on a low fat diet, and 2 were unimproved

[This is an unusually high percentage of improvement after cholecystectomy for cholesterosis —Ed]

Calcification of the gallbladder is sometimes an inci

(3) Ann Surg 117 450 455 March 1943

dental autopsy finding in older patients It seldom produces clinical symptoms, but its close relationship to chronic gallbladder disease and the problems involved in differential diagnosis are of utmost importance Maximilian J Hubeny, Samuel M Marcus and Alex B Ragins[4] (Cool County Hosp) present three proved cases of calcified gallbladder and three in which diagnosis was suggested by roentgenograms but was not surgically verified One of the three cases is given here



Fig 199 (left) —Case 1 Cholecystogram showing well defined calcareous shadow conforming in position and contour to gallbladder
Fig 200 (right) —Same case Calcified gallbladder and stones.

Two years before admission, a woman, 40, began to have dull right upper quadrant pain radiating around the right side of the abdomen to the back just beneath the right scapula She had belching, bloating and a sense of fulness in the epigastrium following a moderately heavy meal of fatty or fried foods She had lost 30 lb in a year Physical findings were tenderness and rigidity in the right upper quadrant and a firm palpable mass extending 4 in below the right costal margin Cholecystography revealed a well defined calcareous shadow conforming in position and contour to the gallbladder

(4) Radiology 39 88 91 July 1942

(Fig 199) Clinical diagnosis was chronic cholecystitis and cholelithiasis An exploratory laparotomy showed the gall bladder the size of a peach, its serosal surface pale and the adherent subjacent wall calcified, with areas of calcification extending also into the muscularis A small stone was found in Hartmann's pouch The gallbladder was removed and recovery was uneventful

The gallbladder measured 8 5×5 0×4 25 cm, with thickening of the wall to as much as 5 mm, including the fundus and body and extending to the duct Diffuse calcification was present, particularly over the inner aspect Attached to the wall by soft yellowish gray material were numerous faceted stones to 10 mm in diameter (Fig 200) The inner lining was yellowish gray and partially calcified Microscopic examination showed dense fibrous connective tissue infiltrated by streaks and plaques which stained black by the von Kossa technic (calcium) Diagnosis was calcified gallbladder and cholelithiasis

Pathogenesis of calcified gallbladder is not well understood Calcification is usually demonstrable in a flat film of the abdomen Differential diagnosis of calcareous shadows in the right upper quadrant is, however, sometimes difficult even after all possible methods of examination have been tried Differential diagnosis includes gallstones, renal and ureteral calculi, calcium suspensions in mucoid bile, calcified mesenteric nodes, calcified ecchinococcus cyst, calcified fecaliths in an undescended appendix and, in elderly people, calcified deposits in the sternocostal cartilages Rigidity and a fixed shadow in the right upper quadrant with calcareous periphery are important roentgen signs

Tumors —Hamlin Mattson[5] reviewed the records and specimens of *carcinoma of the gallbladder* of the past decade available in Minneapolis and St Paul institutions He found 60 cases in which diagnosis was confirmed by biopsy or autopsy, after cases with fragmentary records were discarded

The youngest patient was 31 and the oldest 85 aver

(5) Minnesota Med 985 988 December 194?

age age 65 4—in males 68, in females 63 3 There were 36 females and 24 males, a ratio of 1 5 to 1, the usual ratio in the United States being 3 females to 1 male

Most patients gave a history at least suggestive of malignancy The disease began acutely in most cases Pain was present in 86 per cent In only 13 per cent was there a long preceding history of gallbladder disease ranging from 3 5 to 37 years Half gave a history of three months or less, 80 per cent a year or less and 20 per cent over a year In 33 per cent the pain was dull and constant, usually in the right upper quadrant or epigastrium, in 5 per cent it began as colic and ended with steady pain

Weight loss was a striking feature, in no case was a notation of "no weight loss" made In 20 per cent, the amount was not specified Losses ranged from 10 to 60 lb, average 27 5 lb In 30 per cent it preceded or was concomitant with onset of other symptoms Nineteen of the 29 patients who had lost specific amounts of weight also complained of anorexia, nausea or vomiting, or all three

Jaundice was present in 51 6 per cent, usually of gradual onset and steadily increasing severity Terminal icterus indexes up to 135 and 178 were frequent The severely jaundiced patients had ductal obstruction liver metastases usually accounted for the milder types In one case, jaundice was due to torsion of the common duct Anorexia, nausea or vomiting or all three were found in 70 per cent, bloating and belching in 45 per cent

A mass was felt in the right upper quadrant in 48 per cent usually it was hard and nodular and moved with respiration, 60 per cent of those with a mass complained of tenderness on palpation The liver was enlarged in 48 per cent

A nonfilling organ with or without stone shadows is to be expected in carcinoma of the gallbladder Cholecystograms made in 25 cases showed a nonfunctioning

gallbladder and calculi were visible in 12 Stones were found to be present in 70 1 per cent of these cases

Hemoglobin in 45 cases averaged 74 per cent, those with the lowest values, 26, 34, 45 and 46, showed evidence of hemorrhage into the gastro intestinal tract

There were 54 adenocarcinomas, 4 squamous cell and 2 colloid carcinomas Grossly scirrhous carcinoma was commonest, the gallbladder wall was hard and cartilaginous on palpation A few patients had involvement of the entire gallbladder wall with obliteration of the lumen Papillary carcinomas were less frequent Colloid carcinomas filled the gallbladder lumen The four squamous cell carcinomas resembled the scirrhous in gross structure

Metastases were noted in the liver in 38, porta hepatis in 19 peritoneum in 11, cystic duct glands in 11, retroperitoneal lymph nodes in 6, omentum in 6, lungs, duodenum, pancreas and colon in 4 each, adrenals and mesenteric lymph nodes in 3 each, kidneys, spleen and stomach in 2 each and sternum and mediastinum in 1 each In one case metastasis to the humerus was the first intimation of the disease In one, the duodenum was involved directly causing obstruction

Even though a direct relationship between calculi and carcinoma has not been proved, the two conditions occur most frequently together, and calculi are at least a warning sign Graham has concluded that 4 5 per cent of women of cancer age who have gallstones will develop carcinoma of the gallbladder Lahey, Graham, Boyce and McFetridge and Lam among recent authors, advocate prophylactic cholecystectomy in women with gallstones Before any such policy is undertaken generally mortality and morbidity figures not now available should be obtained

There is, then no diagnostic clinical picture for carcinoma of the gallbladder for the clinical picture fits many cases of benign biliary disease or cancer in other

organs The outlook is gloomy for diagnosis early enough to salvage these patients There is no instance of successful removal in this series

More general use of peritoneoscopy should eliminate some exploratory operations which only hasten the end More hope lies in revision of attitude toward the patient with gallstones who is 50 or over and who has had one or two attacks of colic A gallbladder with stones has a greater chance of developing carcinoma than one without stones Even though the danger of loss of life from carcinoma of the gallbladder were the same or less than the danger from operative procedure, there are other possible tragic developments than malignancy to consider There should be more follow up studies like that of Jaguttis, who traced 114 patients with cholelithiasis treated conservatively for 10 to 25 years Five developed carcinoma of the gallbladder, 13 died of cholecystic disease, 25 were operated on for complications, 4 of whom died

Calculi are associated with either inflammation or carcinoma Innocent gallstones are a myth

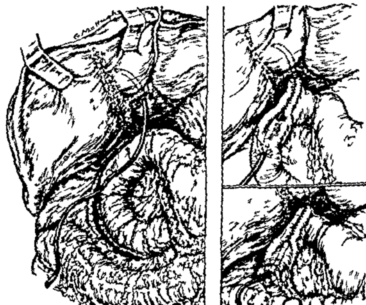
Technic—*Implantation of the hepatic duct into the duodenum or stomach* may become necessary as a result of operative injury to the common bile duct in the treatment of gallstones or following resection of the common bile duct for carcinoma Many methods used are unsatisfactory because of technical difficulties or subsequent stenosis Lester R Dragstedt Ormand C Julian J Garrott Allen and Frederick M Owens, Jr[4] (Univ of Chicago) use a method the principle of which has not been heretofore described

CASE 1—Woman, 35, had a cholecystectomy performed for symptoms suggestive of biliary colic which had been present for the previous 19 years She was entirely relieved for six months and then noted jaundice and generalized pruritus The jaundice increased steadily during the next two months and severe colic like pain appeared in the right upper quadrant

(4) Surg Gynec & Obst 87 1-6 199 August 1948

When seen, she was deeply jaundiced, the icteric index was 185 and there was no bile in the stools Diagnosis of obstructive jaundice was made

At operation, the gallbladder, common bile duct and free portion of the hepatic duct were missing Dense scar tissue on the under surface of the liver was dissected free, and the greatly dilated intrahepatic portion of the bile duct was opened This yielded about 20 cc of colorless mucinous fluid Since the opening was flush with the liver surface and the region relatively inaccessible, the largest rubber catheter



Figs 201 (left) 202 (top right) and 20 (bottom right) —Method for making anastomosis between intrahepatic bile duct and duodenum

(no 18, F) that could be introduced was inserted snugly into the hepatic duct and passed upward into the liver for about 5 cm *The duodenum had been freely mobilized in the previous* dissection in searching for the common bile duct The catheter was placed against the anterior wall of the second portion of the duodenum (Fig 201), which was infolded over the catheter for 2 cm with silk sutures as in the Witzel enterostomy The free end of the catheter was introduced into the lumen of the duodenum and then out again through a stab wound 4 cm distally (Fig 202) Both entrance of the catheter into the

duodenum and exit were tightly closed the latter being re enforced by a generous tag of omentum Two stay sutures were placed in the scar tissue, one on either side of the aperture into the hepatic duct The duodenum was slid along the catheter against the hilus of the liver and held in place by the stay sutures (Fig 203) The catheter was thus completely covered The abdomen was closed in the usual manner and the catheter brought out through the incision The drainage from the tube remained straw colored for several hours, then became defi nitely bile tinged and progressively darker until normal appearing bile drained freely Convalescence was satisfactory The catheter was removed in 10 days, bile immediately ap

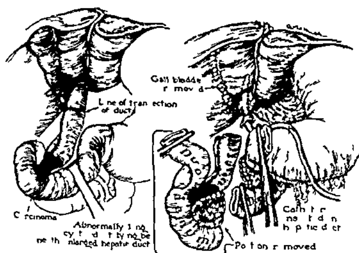


Fig 04 —Carcinoma of common bile duct and cystic duct which emptied abnormally low into common duct

peared in the stools, but the icteric index remained abnormally high for 3½ months Jaundice then disappeared, and the pa tient has remained well for over two years

In view of the operative findings the long period (six months) of good health and freedom from jaundice after cholecystectomy is interesting Probably the ducts were not directly damaged at this operation, but some other factor, possibly interference with the blood supply to the ducts, was responsible for their subsequent gradual disappearance with onset of obstructive jaundice

CASE 2—In a man, 67, diagnosis of obstructive jaundice, probably due to cancer of the head of the pancreas had been made At operation, the liver was markedly enlarged dark green, firm and nodular The gallbladder was collapsed and contained a small amount of thick gray fluid The common and hepatic ducts were enlarged and tensely distended to a point where the duct entered the pancreas The tissues here were hard and fibrous, and a tentative diagnosis (subsequently confirmed) of cancer of the common bile duct was made Pancreatoduodenectomy was performed and the hepatic duct implanted into the stomach, as illustrated in Figures 204 and 205 Recovery was satisfactory, bile drained freely from the tube in the hepatic duct until it was removed two weeks later A duodenal fistula then developed and persisted The subsequent course was downhill despite almost daily transfusions of blood, plasma or amino acids, and the patient died four months after operation

Autopsy revealed extreme emaciation no subcutaneous and depot fat and biliary cirrhosis without fatty infiltration of the liver The pancreatic duct was completely occluded and dilated, and the remaining pancreas was atrophied and fibrotic This atrophy was limited to the acinar tissue, the islets were normal

The absence of fatty infiltration of the liver is significant in view of the complete occlusion of the pancreatic ducts No pancreatic juice could enter the intestinal tract This finding is in harmony with results in the dog following ligation of the pancreatic ducts and suggests that lipocaic deficiency is not a prominent feature, at least in the immediate postoperative period The emaciation can be accounted for on the basis of the duodenal fistula, the absence of pancreatic digestion and the impairment of liver function which doubtless interfered with the utilization of the plasma and amino acids supplied The plasma protein concentration persisted at a low level and did not respond to parenteral amino acid therapy The case is presented as offering a satisfactory method of dealing with the hepatic duct after pancreatoduodenectomy but raises the question—should not the pancreatic duct be reimplanted into the intestine? Many

patients with long standing biliary obstruction are handicapped by serious impairment of liver function and may not respond satisfactorily to intravenous administration of plasma or amino acids Complete removal of pancreatic digestion by ligation of the pancreatic ducts produces an additional handicap to adequate nutrition which in some cases may determine the issue The severed pancreatic duct in the dog may be readily implanted into the small intestine by the method described here for

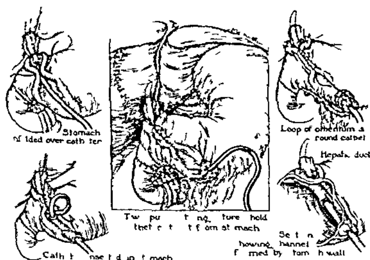


Fig 205 —Method of reconstruction after pancreatoduodenectomy and for implantation of short hepatic duct into stomach.

the hepatic duct In this case, however, infolding is omitted A small ureteral catheter is tied into the pancreatic duct, made to traverse the small intestine through small stab wounds and then led to the exterior After four or five days the catheter is removed and the high secretory pressure of the pancreas maintains the new opening into the intestine Possibly in some cases this method might also succeed in man The duodenal fistula doubtless resulted from anastomosis of the stomach with the horizontal portion of the duodenum which is partly

deficient in peritoneal covering It would have been better surgical judgment to have closed the duodenum and made an anastomosis with the side of the jejunum

[One cannot help wondering what advantage there is to leading the catheter outside as in Case 1 If the tube is allowed to remain in the duodenum it will eventually be passed as was shown by MacArthur *and other surgeons after him* —Ed]

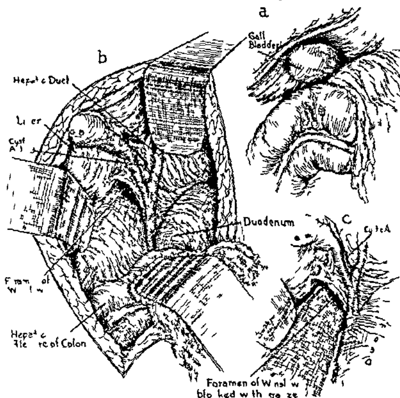


Fig 06—*a* Anatomi rel tions of gallbladder ard hepatic flexure when ab*d men is first opened b Hepatic flexur and duodenum mobilized to left* and held in th s position w th etractors on gauz pads Clamp on gallbladd r ot shown but by tra t on and mobilization of duodenum and hepatic flexure to l ft this exposure of du t a l foramen of Winslow is obtained Note also isualization of cystic artery w th periton *im over duct oper ing c* Foram n of Winslow blo ked with gauz (Lahey below)

Surgical exposure of the gallbladder and bile ducts developed by Frank H Lahey[6] (Boston) some years

(6) Surg Gynec & Obst 44 448 Oct ber 1927

ago has been so satisfactory that he describes the technic Adequate exposure of the organs in the pouch of Morison to allow operation in a dry field and under direct vision has always been a problem It was realized that by mobilizing to the left the structure into which the duct is inserted and keeping its origin in the fissure of the liver fixed, the duct could be straightened out put on the stretch and thus brought up out of its deep position and made clearly visible and closer to the abdominal wall Ample length of the incision is also important in exposure

TECHNIC—Spinal anesthesia is used The abdomen is opened and the gallbladder exposed, grasped with a right angle clamp or any other type preferred and pulled up and out while the duodenum is pulled to the left so that any bands between duodenum and gallbladder are put on stretch and severed The hepatic flexure, often fixed by bands to the undersurface of the liver is freed so that the flexure can be completely dislocated to the left The field is then ready for exposure

A long folded, wet pad is placed over the outer edge of the duodenum up to the pylorus and, with a Deaver retractor placed over it, retraction is made to the left The hepatic flexure and ascending colon are pushed to the left and another gauze pad is placed along their external edges as shown at *b* in Figure 206

A Deaver retractor is placed over the area and the flexure and ascending colon are pulled to the left This completely exposes the pouch of Morison As the duodenum and hepatic flexure with the retrocolic duodenum behind it are pulled to the left the common and hepatic ducts are put on stretch and made completely visible If another clamp is placed on the ampulla and the gallbladder further elevated traction on the cystic duct will demonstrate the duct and its entrance into the common duct and so open the foramen of Winslow that it, with its posterior boundary made by the vena cava will be plainly visible (Fig 206, *b*)

A gauze strip is passed into the foramen of Winslow to block it (Fig 206, *c*) and the remainder of the strip is so laid into the fossa of Morison that infected bile escaping on opening the ducts or blood accumulating at the apex of the deepest point of the operating field represented by the fora

men of Winslow will not pass into the lesser peritoneal cavity to cause subhepatic or subphrenic postoperative abscess

With this exposure, flaps of peritoneum can be safely cut from the gallbladder with which to cover its bed after its removal Course and position of the hepatic artery and course and relation of the cystic artery to the cystic duct can be readily demonstrated and visualized (Fig 206, *b* and *c*) Accurate dissection of the cystic duct down to its point of entrance into the common duct can be accomplished Often the discharge of bile from torn, small accessory ducts occurring at this point can be demonstrated, the open end of the accessory duct picked up and tied and the postoperative escape of bile into the wound from the open end of the accessory duct prevented When there is escape of bile after cholecystectomy, it is in most cases from tears not discovered, and therefore not ligated, in the accessory bile ducts

By this exposure the cystic artery can always be found first, dissected, cut and clamped, and then the cystic, common and hepatic ducts can be dissected accurately This plan has played a great part in lowering mortality and has given confidence to explore the common ducts in many cases Traction on the duodenum and the hepatic flexure by retractors on top of gauze in no way increases postoperative distention or complicates recovery

From 1935 to 1940 William S Carpenter and C Fremont Vale[7] (Wayne Univ) have used *cauterization of the gallbladder mucosa with solutions of phenol and alcohol,* the procedure often called chemical cholecystectomy, as a preferred method for patients in whom cholecystectomy seemed unwise They have done this in the hope that it would prove more successful than cholecystostomy, which in their experience is often followed by recurrence of symptoms and pathologic changes

TECHNIC —The gallbladder fundus is opened, bile is aspirated and any stones present are removed Usually a portion of the free edge of the gallbladder is excised, and the remainder of the mucosa is treated with four to six applications of 95 per

(7) Arch Surg 45 935 944 December 1942

cent solution of phenol, each of which is followed by application of 95 per cent solution of alcohol and drying with a sponge No attempt is made to block the cystic duct The phenol and alcohol are allowed to gravitate well into the ampulla of the gallbladder A soft rubber tube is inserted down to the ampulla, and the remnant of the gallbladder is folded and sutured about this tube, which emerges through the fundus Drainage is carried out for 8 to 10 days

The authors have performed this operation in 47 cases In general, convalescence was smooth despite the acute process found at operation Elderly persons tolerated the intervention especially well In no case did a fistula persist Four of the patients died in the hospital Three of these were poor risks with an acute process, and the fourth had a gastric resection in addition and died from a complication of that operation

Contact was made with 34 of the patients, the average time since operation being a little less than four years Twenty nine were well, three remained free from symptoms if they were careful of their diet and two reported their condition as about the same

Graham Cole examinations were made on 18 patients from six months to four years after operation Regardless of symptoms, the gallbladders of seven were visualized with varying concentrations of the dye Some of the gallbladders, which did not function previous to operation, were now visualized

An experimental study on 14 dogs and swine showed that despite extensive chemical cauterization the mucosa of the gallbladder regenerates rapidly It appears that some of the deeper glands in the wall survive and become the source of new epithelium

The term of chemical cholecystectomy is a misnomer, because the gallbladder is not completely eliminated as a functioning organ

On the basis of 76 cases in which the patients were treated at the New England Deaconess Hospital, Harold

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( ) Arch Surg 45 935 944 December 1942

the gallbladder or pancreas are essentially the same as in the patient without diabetes Marked diminution in insulin requirement will sometimes be seen in patients with these lesions and in obstructive jaundice following operative release of the obstruction

S H Gray, Carl J Heifetz and J G Probstein[6] (Washington Univ) studied the *effect of division of the sphincter of Oddi on the bile diastase of the dog* Their experiments show that normally the hepatic or gall bladder bile of the dog contains no diastase, or negligible amounts of it It is evident that when the sphincter of Oddi is divided assuming a priori that the diastase comes from the duodenal juice, there is a reflux of duodenal contents into the biliary tree as measured by the appearance of diastase in the cannulated bile Furthermore, at least when the cannula is inserted, some of the contents rise as high as the gallbladder Whether the contents would reach this level had not the gall bladder been decompressed by the insertion of the cannula cannot be answered from these experiments Besides, it has not been proved that a similar reflux can occur without division of the sphincter of Oddi Such experiments however are quite feasible The experiments likewise throw little light on the occurrence of this reflux in the human being, nor has the opportunity to perform the needed experiments for verifying this assumption presented itself That spasm of the sphincter of Oddi does occur has been adequately demonstrated It is almost axiomatic that if muscular spasm occurs, its opposite, muscular relaxation must also sometimes be present Whether this relaxation is sufficient to permit reflux of duodenal contents into the biliary tract is yet unanswered If it does occur, a potential etiologic factor of disease of the biliary tract is apparent

It has been suggested that in some cases acute cholecystitis may have as an etiologic factor the reflux of

(6) Arch Surg 47 160 164 August 1943

E Eisele[5] finds that the *results of gallbladder surgery in patients with diabetes mellitus* are as good as those obtained in patients without diabetes Complete relief of symptoms was afforded in 77 per cent of 65 cases with benign gallbladder disease, partial relief in 12 per cent, and no relief in 11 per cent Operative mortality for the entire series, including benign and malignant lesions is 3 9 per cent For those with benign gallbladder disease, including acute and chronic lesions and complications, operative mortality is 4 6 per cent

The eradication of a diseased gallbladder will neither heal nor lessen the severity of diabetes, as measured by the insulin requirement one year before compared with one year after operation The presence or absence of jaundice in the diabetic patient with benign gallbladder disease does not affect the severity of the diabetes subsequent to successful operation

The incidence of complications is considerably greater in the diabetic than in the nondiabetic Twenty two per cent of the benign gallbladder lesions came to operation with complications which included hydrops, empyema, gangrene, perforation and pancreatitis Except for the immediate operative mortality in the group (14 per cent), the result of surgical treatment was excellent

Perforation of the biliary system by calculi occurred in 14 per cent of all patients with benign gallbladder disease coming to operation Two thirds of the perforations were in acutely inflamed or empyemic gallbladders

The patient with gallstones should be operated on when the conditions of time place, surgeon and physician are propitious Indication for operation must be based on dangers incident to gallstones in the nondiabetic greater susceptibility to perforation and greater liability to arteriosclerosis in the diabetic

Indication and results of surgical treatment of the diabetic patient with an obstructive malignant lesion of

(5) Ann Surg 118 107 115 July 1943

bladder which is just getting under way, thereby producing the so called "two minute pause" After the first 4 or 5 minutes, however, the sphincter enters a period of progressive relaxation which lasts for an average of 17 minutes Meanwhile, the gallbladder begins its main phase of contraction which lasts for an average of 30 minutes Evidence from animal experimentation suggests that the reason why the hormone acts on the sphincter for a shorter time than on the gallbladder is that during fasting the tone of the sphincter is maintained by a local nerve net which has a higher threshold than that of the gallbladder

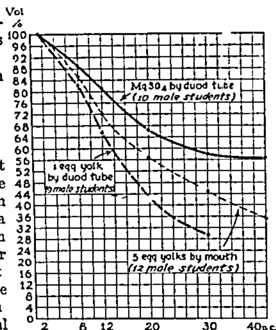


Fig 207 —Mean curves comparing rate of emptying of gallbladder in 10 students receiving $MgSO_4$ intraduodenally with rate in students of comparable age receiving egg yolk orally and intraduodenally Ordinates volume of gallbladder abscissas minutes after salts or egg yolk (Boyden above)

Common Duct —Abraham Strauss, Joseph Gross and Seymour Kyman[8] (Cleveland) report a case of *congenital atresia of the common bile duct* successfully treated by choledochoduodenostomy The common duct ended in a blind point as it passed behind the duodenum Bleeding from the rectum was a prominent complication This is the seventh recorded successful operation

(8) Ann Surg 11 723 7 7 May 1943

pancreatic juice into the gallbladder This evidence also rests largely on the finding at operation of appreciable amounts of diastase in bile from the gallbladder of these patients Unfortunately any effect of the prolonged re flux of duodenal contents into the gallbladders of the dogs might be obscured by the irritative effects of the cannula It was noted at autopsy, for instance, that the gallbladders of these animals were thickened and scarred and so contracted as to envelop the cannula closely It could hardly be concluded from this that the reflux of bile was totally responsible for the pathologic change

Edward A Boyden, George S Bergh and John A Layne[7] (Univ of Minnesota) *analyzed the reaction of the human gallbladder and sphincter of Oddi to magne sium sulfate* This drug is an effective agent in evacuat ing the human biliary tract, but is inferior to egg yolk 30 cc of a saturated solution introduced directly into the duodenum induces, within 30 minutes, an average decrease of 42 per cent in the volume of the gallbladder and lowers the sphincter resistance 3 cm water (manom eter reading) In the same interval egg yolk lowers the gallbladder volume 71 per cent and sphincter resistance 7 cm (Fig 207)

Magnesium sulfate acts on gallbladder and sphincter in the same way and for the same length of time as egg yolk It differs only in degree, a characteristic which may be attributed to slower absorption rate or less effective chemical action Accordingly, magnesium sulfate like egg yolk, is to be considered a hormone producing sub stance which acts independently, through the blood stream, on the gallbladder and the sphincter of Oddi

The two end organs however, react differently to a given stimulus Initially a dose of egg yolk or magne sium sulfate usually causes the sphincter to contract This in turn may interrupt the contraction of the gall

(7) Surgery 13 723 733 May 1943

B Wagner[9] (Philadelphia) review 175 cases of *congenital cystic dilatation of the common bile duct* and report a case The disease predominates in females and occurs principally in children and young adults Congenital maldevelopment probably forms the basis of the abnormality The most plausible explanation is that of Yotuyanagi (1936), that etiology lies in inequality of proliferation of the epithelial cells at the stage of fetal physiologic epithelial occlusion of the common bile duct

Characteristic pathologic finding is a large cystic dilatation of the duct The ducts at the upper pole of the cyst are usually dilated whereas at the lower pole the intraduodenal portion of the duct is usually constricted or angulated Frequently the liver is enlarged or may show biliary cirrhosis

Salient symptoms and signs form a diagnostic triad—tumor, jaundice and pain Acholic stools may occur, and bile may be present in urine Symptoms may begin early and occur intermittently for years Roentgen studies and peritoneoscopy may aid in confirming diagnosis Diagnosis was made or suspected in only 22 cases (12 6 per cent), but consideration of the possibility should lead to more frequent correct diagnosis

Procedure of choice is primary anastomosis of the biliary and intestinal tracts Anastomosis of the cyst itself to the duodenum is accompanied by lowest mortality but in good risk patients extirpation of the cyst with primary anastomosis to the duodenum is preferable because the cyst may harbor infection and regurgitated food The latter procedure was performed, with recovery in the case reported

Mortality in the entire series was 58 per cent, but with primary anastomosis of the biliary and intestinal

(9) Ann Surg 117 355 386 March 1943

The malformation must be differentiated from five other conditions presenting jaundice in the new born (1) In icterus neonatorum the jaundice usually disappears by the end of the second week The liver is not enlarged and stools contain bile pigment (2) Erythroblastosis foetalis is usually fatal the first few days or weeks of life It is marked by jaundice, large liver and spleen and increased erythroblasts It may be suspected from the gold colored vernix caseosa and hypertrophied placenta (3) Jaundice of hemolytic sepsis is differentiated by fever, leukocytosis, progressive anemia, toxicity and no acholic stools (4) Congenital syphilis may be identified by blood test and the roentgen appearance of the bones (5) Obstructive jaundice from inspissated bile or mucus may give a picture indistinguishable from atresia and may require surgery for relief There may or may not be normal stools in the beginning, as this depends on when the duct becomes occluded

Even in cases of atresia jaundice may not be evident until a few weeks after birth One must not be misled by the color of the stools at birth Although they may be yellow and appear normal they will have no bile in them Proved cases have shown that they may not become clay colored until 3 to 14 days after birth The physician may feel loath to urge operation on certain cases of atresia that may be operable if he believes that jaundice from birth is a sine qua non of atresia Thus infants have been allowed to die only to find at autopsy that they had an operable condition Ladd states that, as a rule, if one delays in making the diagnosis of atresia for four to six weeks the chance of error is not great Further delay serves no good purpose but lowers the resistance of the child so that operation may then be fatal Operation should be urged in atresia despite the fact that only 17 20 per cent will be operable

Thomas A Shallow, Sherman A Eger and Frederick

found during operation in the common duct was migrating from the gallbladder to the duodenum Probably, it is only under these circumstances that the choledochal bile may be sterile in the presence of common duct stones The predominant bacteria in the various parts of the biliary system were Bacillus coli, which occurred 72 times, and streptococcus, which occurred 49 times Other bacteria recovered were Bacillus typhi (8 times), Bacillus pyocyaneus (4 times) and staphylococcus, saprophytes and associated bacteria (13 times)

Bacterial infection of the common duct is always associated with infection of the other parts of the biliary system, and the bacteria found are generally of the same species The choledochal bile appears to have strong bactericidal power

H B Morton[1] (Lincoln, Neb) reports two cases of *common bile duct calculus* in which stones remained in the duct after operation In both cases the stone was disintegrated by the action of ether and alcohol injected into the T tube Dissolution of the stone and its passage into the duodenum were demonstrated by cholangiographic studies Five cc of a mixture of one third ethyl alcohol and two thirds ethyl ether was injected daily for five days in one case, and 6 cc of the mixture for six days in the other

Arthur W Allen and Richard H Wallace[2] (Massachusetts Gen'l Hosp) attempt to evaluate certain points in the technic of an operation on the common bile duct reported in 1935 At that time they described a method of *draining the common hepatic duct* with a rubber catheter brought out through a stab wound in the right flank, along with a short cigaret wick placed in the subhepatic fossa (Morison's pouch) They advocated tight closure of the original vertical (right paramedian) incision and believed that the technic would

(1) Surgery 12 591 598 October 1942
(2) Surg Gynec. & Obst 75 273 278 September 1942

tracts, mortality was 27 per cent Prognosis depends on preoperative recognition of the lesion, the patient's condition at operation and type of therapy

In a study of the *bacteriology of the common bile duct*, Gerardo Elkeles and P L Mirizzi[8] (Cordoba, Argentina) found that choledochal bile is sterile in a large number of patients with disease of the extra hepatic bile ducts In their operative material this occurred in 41 of 75 cases, or 54 7 per cent With correction for cases in which bacterial contamination was probable, the figure would be 64 per cent

Sterility of the choledochal bile is especially frequent in uncomplicated chronic calculous cholecystitis and atrophic sclerosing cholecystitis and was observed in 25 of 34 such cases, or 73 5 per cent Since the possibility of contamination could not be excluded in 7 of 10 cases of uncomplicated cholecystitis in another series, the frequency of sterile common duct bile in such cases may be about 91 per cent The results were similar in cases of empyema or hydrops of the gallbladder, when the gallbladder was the only organ involved by the disease The choledochal bile was frequently infected when there were complications of an organic nature, such as pericholecystitis hepatitis or odditis or of a functional nature, such as dyskinesia

Stagnation of the choledochal bile, resulting from dyskinesia or stenosing odditis, in the absence of stone resulted in infection of the common duct bile in four of seven cases In the remaining three cases actual infection was not observed, although macroscopic alterations of the choledochal bile existed

Stones in the common duct were the most frequent cause of infection of choledochal bile Infection occurred in 16 of 18 cases, or 88 8 per cent, in the remaining 2 cases it seemed probable that the calculus

(8) Ann Surg 116 360 366 September 1942

common duct or for closure of a fistula between the duodenum and the gallbladder During the same period, the incidence of sepsis, hernia and evisceration in wounds drained after operations for acute cholecystitis

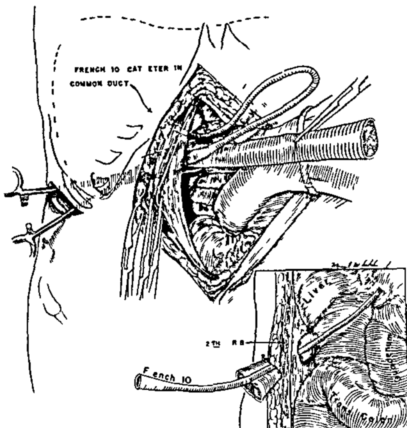


Fig. 98.—Introduction of common duct drainage tube and cigaret wick through a stab wound in right flank well below the twelfth rib This must be done under vision since it is possible to damage the hepatic flexure of the colon or pull omentum through the wound Inset shows proper location of tubes with abdominal wall cut away

was practically identical with that of drainage through the wound after common duct exploration

The average postoperative hospital period was 16 1 days following stab wound drainage and 18 7 days fol

give a lower incidence of infected wounds and incisional hernias Recently, they published follow up studies on 775 patients who had had common duct exploration with special reference to the graded dilatation of the sphincter of Oddi, and reported 4 fatal cases of bile peritonitis The present analysis includes a review of 18 cases of bile peritonitis in that series

There were adequate data for the present study on 744 of the 775 patients, in 479 external drainage was through the main incision A sufficient number of cases (233) in which separate, carefully planned, stab wounds were used for drainage, with tight closure of the main wound, were available for comparison A transverse incision was used in only 32 individuals with 3 cases of major wound infection and 3 of subsequent hernia in the scar This number is too small to be of much significance and, for this reason, has been excluded from further analysis, the figures, however, suggest an incidence of infection and hernia comparable to that in patients with drainage through a vertical incision The types of incisions and their sequelae are shown in the accompanying table

TYPES OF INCISIONS AND SEQUELAE

	Drainage through Vertical Incision (479)		Stab Wound Drainage (233)		Drainage through Transverse Incision (32)	
	No	%	No	%	No	%
Major wound infection	70	14 6	8	3 4	3	9 3
Dehiscence	8	1 7	0		0	
Subdiaphragmatic abscess	4	0 8	2	0 85	0	
Hernia in scar	34	7 1	2	0 85	3	9 3
Deaths	24	5 0	9	3 8	0	

Opening the duodenum was found to increase the incidence of wound infection This was true whether it was opened for transduodenal exploration of the

The most frequently used drainage tube was a no 10 French whistle tipped catheter There was no apparent difference in the amount of drainage whether the tip was placed up toward the liver or down toward the duodenum, however, in small ducts the catheter should point toward the liver When this catheter was removed on the tenth day, biliary drainage practically always ceased within 48 hours and the wound was usually dry in 24 With larger catheters, drainage was prolonged after removal, and even more so after use of a T tube The average postoperative stay for patients with drainage by a catheter was 16 days and for those with drainage through a T tube 21 7 days This difference seems to be chiefly due to prolonged drainage of bile following removal of the T tube However, wound sepsis is also an important factor, as most T tubes were brought out with the abdominal drain through the operative incision The authors have felt that 10 days was enough for the tube to remain in the duct in patients who have had careful graded dilatation of the papilla of Vater to 7 mm They have removed the cigaret wick on the tenth day and the catheter as soon afterward as the no 00 chromic catgut suture, holding it in the common duct, would let go

Reaction following removal of the drainage wick occurred in 19 subjects twice when the stab wound was used and 17 times when the operative wound was used Removal of a short dependent wick placed away from the operative field is followed by less reaction than removal of a longer wick brought upward through the operative incision Removal of the shorter wick also gives less discomfort to the patient

Lateral stab wound drainage is avoided in patients with very thick abdominal wall, who are best operated on through some modification of the transverse approach, and in secondary operation on the common duct in which one is apt to find the subhepatic space obliterated

lowing drainage through the wound Of those patients with drainage by stab wound, 75 8 per cent were dis charged by the sixteenth day, but only 44 7 per cent of those with drainage through the wound could be dis charged that soon after operation Delayed hospitaliza tion over 20 days was found in 9 4 per cent of those with stab wound drainage, in contrast to 19 4 per cent of those whose drainage was established through the operative incision

Greatly prolonged bile drainage means that an ade quate outlet for bile into the duodenum had not been established All cases of bile peritonitis were reviewed, and two definite causes were found closure of the com *mon duct without drainage and failure of the tube to* drain bile following operation The mechanism seems the same in both cases and is essentially bile leakage from the common duct through the repaired opening or around the nonfunctioning tube, if there is free flow to the outside, convalescence is smooth, if not, some degree of bile peritonitis occurs This carried a mor tality of 22 per cent

An attempt was made to determine why there was no bile drainage through the tubes used in 29 cases The type of tube and of wound closure had apparently no influence on the malfunction of the tube In the four fatal cases of bile peritonitis, drainage was through a stab wound in two and through the main wound in two Technical errors explain failure of the tube to func tion kinking of the tube, a ligature or stitch around the tube, pulling of the end of the tube from the duct and adherence of the sides of the tube The importance of using fresh rubber tubes cannot be overemphasized The authors now follow the rule that every common duct tube must drain bile while the patient is on the operating table, if bile does not continue to drain, the patient is returned to the operating room and the tube made to function

were complicated, two with chronic pancreatitis and one with a swollen lymphatic gland pressing on the common duct Purulent cholangitis cicatricial stenosis in the papilla and a temporary obstruction to sounding

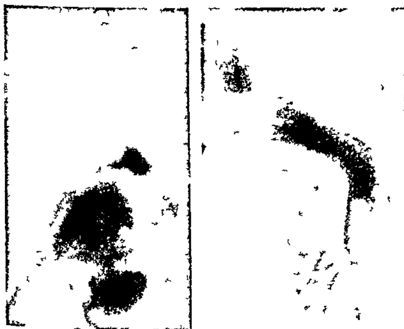


Fig 909 (left) —Circular constriction of hepatic duct where it merges into common duct Normal cholangiogram
Fig 910 (right) —Postoperative study Dilatation (stones having been removed from ducts) large air bubble in common duct—not visible in earlier and later examinations

were found in three without stones One patient had diverticulum of the common duct

Cholangiography gave the following results

Stones in bile ducts	13
Filling defects probably stones	2
Deformation of distal part of common duct (pancreatitis)	2
Local impression in common duct (caused by lymphadenitis)	1
Diverticulum of common duct	1
Dilatation of bile ducts no stones normal passage to duodenum	3
Dilatation of bile ducts no stones no passage to duodenum	11
No passage to duodenum no stones normal width	3
Normal	
	40

by adhesions These should usually be left alone [Drainage through a stab wound to the right of the vertical incision has been practiced by the editor for 20 years with satisfactory results —Ed]

The experiments of Jere W Lord, Jr, and Arthur I Chenoweth[3] (Cornell Univ) established that *a gap in the common bile duct of the dog can be bridged by a free fascial graft* from the anterior rectus sheath fashioned into a cuff around a straight vitallium tube with a holder, with uniform success Venous grafts are only moderately successful, for in 40 per cent of the animals used bile leaked during the first week after operation, and/or sloughing of the graft with formation of a stricture occurred Also venous grafts which take satisfactorily tend to shrink more rapidly and completely than fascial grafts Free peritoneal grafts should not be used, since they sloughed in four out of five instances

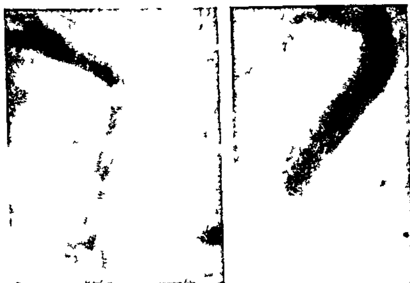
Cholangiography —Statistics show that 12 22 per cent of cholelithiasis patients have calculi in the deep bile ducts, frequently without clinical symptoms Digital and instrumental examinations of the common bile duct are inadequate but possibility of visual control of the deep bile ducts by roentgen examination with opaque medium during operation is a definite step forward This procedure is called primary cholangiography to distinguish it from postoperative, or secondary, cholangiography

O O Schuberth and S E Sjogren[4] (Serafimer Hosp, Stockholm) report primary cholangiography carried out 88 times in 76 operations Calculous cholecystitis was present in all except 10 patients whose gall bladders were already removed and 1 who had chronic cholecystitis without stones

In 27 cases stones were removed from the deep bile ducts before or after roentgen investigation Three cases

(3) Arch Surg 46 45 59 February 1943
(4) Acta radiol 2 80 95 1941

filled but also, to a varying degree, the intrahepatic ramifications As a rule, the distal part of the bile duct (pars duodenalis) tapers to a cone The opaque medi



Fi~ 1? (left) —Secondary cholangiography Stones in common duct verified post mortem Duodenal diverticulum.
Fi~ 13 (right) —Primary cholangiography Stones with obstruction column of opaque medium displays curved outline at the distal end dilatation

um generally empties without difficulty into the duo denum Width of the hepatocholedochus and the intra hepatic branches must be estimated correctly

In 1940, Mirizzi published certain observations which he thought indicated the presence of a sphincter on the hepatic duct where it runs into the common duct Ac cording to Nuboer however, the hepatic duct lacks all signs of muscle in 67 per cent of all adults but exception ally a sphincter like formation may appear In the pres ent material, several normal cholangiograms displayed a circular constriction of the hepatic duct where it merged in the common duct (Fig 209) occurring regularly in several pictures taken one after the other This requires careful anatomic study

stones were extracted prior to the roentgen examination, but in 9 of these the examination disclosed remaining calculi which had been overlooked in digital and instrumental examinations just performed

In 30 cases of uncomplicated cholecystitis, the common duct averaged 7 5 mm wide, varying between 5 and 11 mm These values agree with those reported by Hunt Hicken and Best, and Stenstrom A width of 10

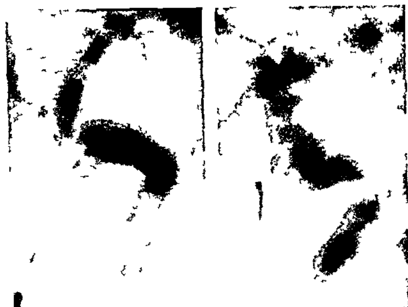


Fig 14 (left) —Primary cholangiography Large stone with dilatation and impeded passage not found when exploring the common duct Scoop could penetrate the duodenum

Fig 21 (right) —Primary cholangiography Dilatation and obstructed passage stones the size of peas in hepatic duct not discovered in instrumental exploration

to 11 mm implies slight dilatation but is not uncommon in simple cases of cholecystitis More pronounced dilatation is uncommon without pathologic processes in the bile ducts themselves but is very common with pathology Of the 27 cases of choledocholithiasis, only 3 displayed a width of less than 11 mm, average 15, minimum 7 and maximum 21 mm Because the more the

Pathologic processes in the bile ducts and head of the pancreas generally produce typical roentgen changes Stones produce filling defects, but such defects may also be caused by pressure on or tension in the common duct, insufficient filling with opaque medium, mucous plugs, blood clots, air bubbles etc All accidental sources of error must be excluded and several pictures taken with repeated injections of opaque material It is then possible to judge whether shape and position of a defect are constant and, as a rule, to determine its cause The shape of the defect is also important An angular shape indicates stones, air bubbles are round or oval and appear in the higher parts of the bile ducts If passage past a defect is impeded, the defect is not caused by air Around instruments that have been inserted e g, cannulas or drain tubes, the filling may be thinned out, the defects sometimes being slightly irregular and difficult to distinguish from small stones Figures 210–215 show defects due to various causes If an obstruction is caused by a calculus which is not too small, it generally produces a defect so that the filled part of the duct has a concave termination downward (Fig 213)

Except fairly uncommon changes in the bile ducts, such as anomalies and tumors and diseases of the pancreas three main roentgen symptoms are of diagnostic importance filling defects dilatation of bile ducts and obstructions of passage

The greatest clinical value of cholangiography lies in the fact that it permits observation of number, size and location of any stones in the bile ducts When it is used extensively the number of choledocholithotomies in gallstone operations is increased In the present study indisputable calculi have been demonstrated in 17 primary and 6 postoperative examinations Stones have never been found after cholangiography in which no stones could be demonstrated However in one patient some muddy bile was discovered In 27 instances

peritoneal subdiaphragmatic splanchnicectomy The extraperitoneal lumbar approach of the two methods allows combining them if this is desirable In study of the problem, he has adopted the following plan (1) splanchnic functional section by injection of alcohol in normal individuals to learn the corresponding changes occurring in glycemia, (2) the same intervention in supposedly pancreatic diabetics to verify its effects on hyperglycemia and glycosuria, and for preoperative functional exploration in the individual case, (3) surgical intervention in pancreatic diabetics in whom indication for operation is established by functional exploration

Manzanilla's observations on 50 normal subjects showed that marked hypoglycemia the day of the alcohol injection was followed by hyperglycemia the second and sometimes the third day, then by hypoglycemia which became stabilized at 20 to 25 per cent below the normal values by the end of the first week This hypoglycemia persisted with slight variations as long as splanchnic block lasted, i e, three to six weeks and in some cases two months

Observations on 18 supposedly pancreatic diabetics established the following facts (1) Hyperglycemia decreases slightly toward the end of the first week, then rises to remain at its former level, this is not pancreatic diabetes and nothing can be expected from surgery (2) Hyperglycemia persists at the same level for one or two weeks then disappears suddenly, to be replaced by normal values (3) Hyperglycemia persists at the same level for one or two weeks, then disappears gradually to be replaced by normal values in one or two weeks (4) Hyperglycemia disappears and slight hypoglycemia is found at the end of the first week, this is followed by fleeting hyperglycemia, sometimes a little higher than formerly, which disappears to be replaced by normal values or a slight hypoglycemia by the end of the second

bile ducts are dilated, the more difficult it is to observe filling defects caused by small stones, dilatation exceeding the limit mentioned requires exploration of the deep bile ducts

For cholangiography to be normal, the filling must empty easily through the papilla into the duodenum An obstruction may be purely mechanical (stones, cancer, etc), but normal passage is frequently impeded without such obstruction being demonstrated

Obstruction to emptying of the opaque medium into the duodenum may occur independently of the kind of narcosis used and of morphine administered prior to operation On the other hand, instrumental exploration of the common bile duct often causes obstruction Passage of the opaque medium is seldom impeded by any causes not due to choledocholithiasis or brought about by sounding Therefore cholangiography should be carried out prior to any exploration of the common bile duct

[Cholangiography is a procedure which is theoretically sound and it will doubtless prove to be of great practical value The chief difficulty now lies in the interpretation of the films —Ed]

PANCREAS

Diabetes Mellitus a Surgical Problem —Confronted by the fact that insulin can only prolong the life of the diabetic patient and make it more or less comfortable and that hopes of preventing progressive development of beginning diabetes or of making it disappear by early use of insulin have been dispelled, many clinicians have recently stated that surgery is destined to solve the problem of diabetes and experimental and operative results support this belief Manuel A Manzanilla[5] (Mexico City) discusses the various interventions He prefers juxtaglandular denervation of the adrenals and extra

(5) Medicina Mexico 526 5 4 Nov 10 1940

but, given a large cystic mass extrinsic to the gastro intestinal tract, possibility of cyst should be borne in mind Roentgen examination is helpful in diagnosis Presence or absence of pancreatic enzymes in the cyst fluid is not pathognomonic

From the embryologic point of view, it is conceivable that certain pancreatic cysts may arise from misplaced remnants of Brunner s glands Such a tumor was found in one case

In the past few years several authors have reported observations of *fibrocystic disease of the pancreas* In 1913 a case of steatorrhea was described which was evidently an instance of this disease, but 11 years passed before the clinical symptoms were associated with the typical pathologic changes in the pancreas Only in the last five years has any appreciable reference been made to the disease

W A Daniel, Jr,[8] reports eight cases observed at Children's Memorial Hospital, Chicago It is a disease of young infants and usually terminates fatally No proved cause has been found Often the condition is apparently familial, however, the child may be the only infant in a large family who has or has had the disorder In Daniel's cases there seems little difference in sex incidence

Much evidence favors the theory that the cause is related to a vitamin A deficiency, but the disease has not been produced experimentally and therefore no conclusion can be drawn Whether or not it is truly congenital is also unproved Little relation to the mother's condition during pregnancy has been found It is worth noting that a twin of the same sex as the patient was free from symptoms

Although each patient presented evidence of pulmonary and pancreatic damage respiratory symptoms were more alarming in most of them In all but two, on

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(8) Am J Dis Child 64 33 49 July 1942

week (5) The effect of alcohol block lasts three to six weeks, as in normal subjects (6) Three patients with glycosuria showed that it is not always related to the glycemic index In the first, glycosuria increased before hyperglycemia began to decrease, in the second glycosuria increased with decrease of hyperglycemia, in the third, glycosuria varied from 8 to 36 Gm per 1,000 cc, while glycemic values ranged from 75 to 125 mg per 100 cc The paradoxical increase of glycosuria could perhaps be explained by taking into account inherently renal factors the renal nerves derive mostly from the celiac plexus *small splanchnic and inconstant lower* or abdominal minimal splanchnic, and are principally vasomotor, partly motor and secretory

Clinical improvement was evident following splanchnic block The patients gained weight working capacity increased appetite was nearly normal, thirst and urine decreased Gangrenous and suppurative processes healed rapidly Manzanilla has operated on five patients with promising results but considering the small number of his cases and the shortness of the period of observation he does not feel justified in drawing final conclusions

R Starr Lampson[6] reports that in 29 cases of *acute pancreatitis* seen at the Hartford Conn Hospital from Sept 1 1938, to Dec 31 1941 the mortality was 33 per cent in those cases in which immediate operation was performed and 5 per cent in those in which operation was delayed or not performed Conservative management is recommended

Cysts of the Pancreas — I Rabinovitch and B Pines[7] review 17 cases collected from the records of Jewish Hospital, Brooklyn The lesion was a pseudocyst in 11 a cystadenoma and a retention cyst in 2 each and an inclusion cyst and a pseudocyst with carcinomatous degeneration in 1 each Diagnosis is sometimes difficult,

(6) Ann Surg 116 367 3 September 194
(7) Arch Surg 45 7 7 746 November 194

shown significant pathologic changes of the intestines Keratomalacia and xerophthalmia may occasionally be present

Until recently, this disease was not diagnosed during life When failure to gain weight or malnutrition, respiratory distress, most frequently coughing, and large, fatty, homogeneous, foul smelling stools are present, diagnosis of fibrocystic disease of the pancreas should be suspected and efforts made to prove or disprove it, because recent methods of treatment offer hope for this previously uniformly fatal disease Laboratory studies should be made when possible, absence or gross deficiency of pancreatic enzymes constitutes definite evidence for diagnosis If such examinations are impossible, a therapeutic test with pancreatic enzymes aids diagnosis, provided all conditions which might produce malnutrition, respiratory symptoms or large fatty stools are excluded Roentgen examinations are of value in diagnosing pulmonary involvement but offer no information which specifically relates the pulmonary changes and general pancreatic damage

Although prognosis remains poor, one patient is still alive at the age of 22 months and illustrates a response to treatment Pancreatic products are the chief therapeutic agent Small enteric coated granules available in almost pinpoint size facilitate administration to infants The amount to be given is empiric but it is probably wise to err on the side of overtreatment From 0 3 to 5 Gm of the granules has been given with each feeding until response was obtained Vitamin A should be administered in large quantities, preferably parenterally The best diet is one of low fat content, protein milk is theoretically the choice, but this was not found to be true In the presence of a fatty liver, choline is of value to decrease infiltration and mobilize the fat in storage Most patients seen by Daniel were almost moribund on admission however with earlier diagnosis and treat

set of symptoms occurred during the first two months of life, but the condition usually did not become severe until later Often respiratory difficulties so overshadow the other symptoms that evidence of pancreatic de ficiency is overlooked On examination, little is dis covered except striking malnutrition and marked diffi culty of respiration Physical signs in the chest are al most always insignificant as compared with the pul monary pathologic changes seen at autopsy and the symptoms they represent Most patients had only a few fine or coarse râles—usually bilaterally—to indicate pul monary damage Occasionally, suppression of breath sounds, bronchial breathing, dulness to percussion or hyperresonance have been detected Rate and frequently depth of respiration are increased and often marked a few days before death The abdomen is prominent, the liver may be palpable Genitalia and extremities share in the process of malnutrition Visual evidence of lack of vitamin A is not common, however, xerophthalmia as well as keratomalacia may be encountered The blood *count* usually *shows* anemia, *degree of leukocytosis* varies Blood cholesterol is low, a dextrose tolerance test gives a flat curve in the later stages a vitamin A absorp tion test shows poor absorption, and normal absorption is evidence against the disease The most important and most difficult laboratory test is determination of pan creatic enzymes in the duodenal contents absence or gross deficiency of these enzymes with the symptoms just listed is pathognomonic

The characteristic and pathognomonic changes of the pancreas are seen chiefly in histologic sections rather than grossly One frequent change is squamous cell metaplasia usually prominent in the lungs The lung changes vary from bronchitis to bronchiectasis or even abscess, as well as emphysema atelectasis and pneumonia The liver may or may not show fatty infiltration Thus far no autopsies at Children s Memorial Hospital have

tion an obstruction was encountered 2 in from the anus X rays showed a small stream of barium by rectum reaching the level of the descending colon There was considerable distention of the small intestine (Fig 216)

At operation 10 hours after admission brown odorless fluid escaped from the peritoneal cavity Greatly dilated bluish loops



Fig 16 —Film of abdomen without use of contrast medium shows pronounced distention of loops of jejunum

of small intestine presented Removal from the cavity was necessary to visualize the site of obstruction A volvulus of the jejunum of about 360 degrees in a clockwise direction, was untwisted by two complete counterclockwise turns The jejunum distal to the volvulus then filled partially with gas Bluish discoloration was also relieved Almost the entire ileum was found on the right of the abdomen, forming a mass of coiled intestine the size of a fist Loops of intestine 1 cm in diameter were filled with inspissated meconium The collapsed colon

ment it is reasonable to expect that much can be done

[Might it not be possible that the changes in the abdominal viscera are secondary to the pulmonary suppuration of infancy?—Ed]

Cysts—The accepted method of *treating large pancreatic cysts* not amenable to excision has been marsupialization This is unsatisfactory, as the fistula may discharge for years and frequently leads to death from retroperitoneal sepsis and thrombophlebitis of the inferior vena cava Anastomosis of the cyst to the stomach and retroperitoneal anastomosis to the duodenum have been done, but Judson T Chesterman[1] (Sheffield) recommends anastomosis to the jejunum because it is easier than any other method and approaches more nearly the principle of dependent drainage He reports a case in which this method was used successfully

Meconium Ileus with Stenosis of Pancreatic Ducts—Inspissation of meconium in the new born resulting in obstruction of the intestine (meconium ileus) with cystic fibrosis of the pancreas was first reported by Landsteiner in 1900 Kornblith and Otani in 1929 made serial pancreatic sections in their case demonstrated marked stenosis of the duodenal end of the duct of Wirsung with extreme dilatation and concluded that the stenosis produced the changes in the pancreas and that these, in turn caused absence of pancreatic secretion in the intestine with alteration of meconium A second case of meconium ileus at Mount Sinai Hospital, New York City, with pancreatic changes almost identical to those described by Kornblith and Otani prompted Elliott S Hurwitt and Ernest E Arnheim[9] to make the present investigation

Boy was admitted because he had not passed meconium since birth 24 hours previously and had intermittent regurgitation of bile stained fluid for 12 hours Abdomen was moderately distended soft and nontender with no peristaltic waves Some oval, elongated masses were palpable On rectal examina

(1) Brit J Surg 30 34 35 January 1943
(9) Am J Dis Child 64 443 4 4 September 194

tion with small cells Throughout the length of pancreas the smaller, and even the intra acinar, ductules were greatly dilated and surrounded by atrophic acini and fibrous tissue These changes were not localized to discrete areas but could be seen throughout the entire cross section of the pancreas Consequently, architecture was completely distorted, and it was difficult to recognize even relatively normal areas for comparison Islands of Langerhans did not seem to be altered Increase in fibrosis was particularly striking in the head Fibrosis was distributed mainly in the periductal and interlobular fashion and did not involve the islets Peripancreatic lymph nodes showed a slight increase in leukocytes Pathologic diagnoses were meconium ileus, fibrosis of the pancreas with stenosis and cystic dilatation of pancreatic ducts, pronounced hypertrophy of the muscular wall of the small intestine and dilatation of loops of jejunum, diffuse, acute, fibrinopurulent peritonitis, pulmonary congestion and focal atelectasis blood cyst of the mitral valve



Fig 17 —Section of duct of Wirsung Extreme dilatation at distance of 3 600 μ from duodenal end of duct ×46

The striking similarity of the pathologic changes in the cases reported in 1929 by Kornblith and Otani and

was about 3 mm in diameter There was no evident atresia anywhere in the small intestine or in the ascending or transverse colon He died 44 hours after operation

At autopsy, the pancreas was normal in size, shape and location The parenchyma was pale grayish white and cut with increased resistance The pancreatic duct in the head could not be visualized Wirsung's duct could not be probed at Vater's papilla, and the opening of the duct of Santorini could not be identified Below the ligament of Treitz the jejunum became tremendously dilated, this dilatation continuing to the proximal few centimeters of ileum The wall and mesentery of jejunum and ileum were thickened Jejunal contents consisted of viscous, mucoid, green, odorless meconium, and the ileum was filled with a cast of inspissated, pale green, firm, putty like meconium Gentle probing of the ileocecal valve demonstrated a narrow lumen Colon and rectum were empty

Serial sections of the head of the pancreas were made 8 microns apart The duct of Wirsung, narrow along the common duct near the duodenum, consisted of small lumens embedded in fibrous tissue The lumens became progressively smaller, stenosis reaching a maximum 280 microns from the first point at which the duct could be distinguished from the choledochus As the duct diverged from the common duct into the substance of the head, the lumens dilated slightly but again showed considerable stenosis 1,184 microns along the tortuous course of the duct Beyond this the duct rapidly became greatly dilated and through the remainder of the head and body appeared as large duct spaces (Fig 217)

Opening of the duct of Santorini was identified in a duodenal fold immediately adjacent to the papilla of Vater For a short distance from the duodenal opening the duct was enormously dilated This dilated section was short, coming to abrupt termination 716 microns from the duodenal opening along the tortuous course of the duct Beyond this was rapid increase in fibrous tissue the duct becoming subdivided into a few small lumens and continuing as a small duct in the head of the pancreas No communication between the ducts of Wirsung and Santorini was demonstrated Throughout the pancreas the periductal fibrous connective tissue was greatly increased, most *severely in the regions of the most pronounced narrowing*

The ducts were lined by columnar epithelium and contained amorphous material of desquamated epithelial cells, products of secretion and deeply eosinophilic staining concretions In some larger ducts were a few polymorphonuclear leukocytes and the periductal connective tissue showed moderate infiltra

caused exceedingly variable symptoms, but the literature records only four cases with symptoms of *hyperinsulinism and hypoglycemia* which were entirely controlled by removal of the extrapancreatic adenoma. To these four, Emile Holman, David A. Wood and Andrew B. Stockton[1] (Stanford Univ.) add a fifth case in which removal of one intrapancreatic adenoma failed to relieve the hypoglycemic symptoms but removal of a second islet adenoma in the gastrohepatic ligament produced complete cure.

In any operation undertaken in a case in which Whipple's triad of hypoglycemic symptoms is present the possibility of multiple adenomas and of an islet tumor in extrapancreatic tissue must be borne in mind. Failure to find an intrapancreatic tumor should be followed by careful search for an islet tumor in sites where heterotopic pancreatic tissue is frequently found. Whipple's essential triad consists of attacks of central nervous system disorder—motor, vasomotor or psychic—coming on during the fasting state, fasting blood sugar levels of 50 mg. per cent or less and immediate recovery from these attacks on administration of glucose by mouth or by vein.

The authors also report a case of heterotopic islet adenoma of the duodenum without hypoglycemic symptoms and a case of islet carcinoma apparently engrafted on a calcified islet adenoma which presumably had been responsible for hypoglycemia of varying severity over 16 years.

A bizarre case of hypoglycemia characterized by episodes of unconsciousness and blood sugar values as low as 33 mg. per 100 cc. is described. The patient's abdomen was explored for an islet adenoma, but none was found. The pancreas was isolated from all surrounding structures, although its arterial supply was not interrupted. No evidences of hypoglycemia have ever again appeared. No explanation for this astonishing result is offered.

(1) Arch. Surg. 47: 165-177, August 1943.

the authors' cases suggests a common cause It has been postulated that the pathologic changes in the pancreas in meconium ileus and pancreatic insufficiency in infancy can be classified into two main groups one in which primary changes are in the ducts (Kornblith and Otani Oppenheimer), and one in which changes are primarily in the parenchyma the ducts being affected secondarily by the fibrous tissue

Intensive study suggests that the disease dates back to early intra uterine life Also, it supports the concept of Kornblith and Otani that a causal relationship exists between stenosis of the pancreatic ducts and meconium ileus The authors accept the view of Farber that the basic lesion in meconium ileus is interference with passage of pancreatic enzymes into the duodenum, no matter what the cause On this basis Farber suggested that inspissated meconium might be washed from the bowel by enterostomy or colostomy, pancreatic extracts or duodenal juice being used as a solvent This suggestion seems of value in this uniformly fatal condition since death is due to mechanical blockade of the intestinal lumen Of four infants treated by this method at Boston Children s Hospital cleansing of meconium from the intestinal tract was successfully performed in three One has remained well for a long time and two died several months later of a chronic pulmonary infection If intestinal obstruction can be relieved thus the ultimate outlook will depend on the degree of pathologic changes in the pancreas Histologic alteration of the pancreas does not seem severe enough to produce actual pancreatic insufficiency, since a similar picture can be seen in cases of extreme atrophy of acinar tissue with marked fibrosis caused by carcinoma of the head of the pancreas of long duration or by complete ligation of the main duct in the experimental animal

Masses of aberrant pancreatic tissue varying greatly in size have been described by many authors and have

The initial volumes varied from 60 to 350 cc As numerous factors could be responsible for such variations, it is suggested that the weight of the spleen should be correlated with its degree of collapse or distention with blood

The maximal volumes seemed to vary in direct proportion to the surface areas of the patients The values for maximal volume ranged between 120 and 650 cc They represented 1½ 2 times the initial volumes in the case of eight spleens, 2 2½ times in eight other spleens and 2½ 3 times in the remaining four spleens

The difference between the maximal and the initial volumes of each spleen represented in large measure the potential space available for storage of blood This varied from 60 to 400 cc Great significance was attached to five spleens which possessed the capacity to accommodate 275, 275, 280 330 and 400 cc blood, representing 4 8 4 7 4 4 5 4 and 6 1 per cent, respectively, of the total blood volumes of the patients concerned (Fig 218)

E L Eliason and L W Stevens[1] (Univ of Pennsylvania) have reviewed the literature of the last 10 years on *surgery of the spleen in blood dyscrasias* and compiled a statistical report showing the mortality and life expectancy following splenectomy in splenic anemia, thrombocytopenic purpura and ictero anemia They have added 63 personal cases

Splenectomy offers the patient with splenic anemia the best chance of survival The earlier it is done, the lower the surgical mortality and the greater the life expectancy One of the authors thinks that this is the only treatment for cirrhosis Operative mortality should not be over 10 per cent at the most, and some patients have lived 20 years

Patients with chronic hemorrhagic purpura who do not respond to conservative therapy should be subjected to splenectomy In acute or fulminating purpura

(1) Surgery 13 177 187 February 1943

SPLEEN

The maximal volume of the human spleen was studied by Patrick P. T. Wu[2] (Mayo Clinic). The volumes of 20 spleens obtained from embalmed bodies at autopsy

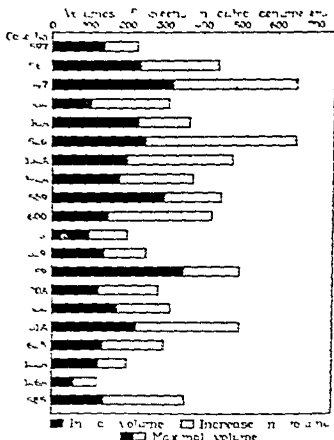


Fig. 215.

were measured by the amount of water they displaced. Then the organs were distended by perfusion with water to produce maximal volumes.

(²) Surg. Gyne. & Obst. 74: 5, July 1942.

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haemorrhagica if the bleeding does not respond promptly to conservative measures, splenectomy should be performed early before the condition is critical. Careful elimination of infection is important in prevention of recurrent purpura. Recurrence of a serious nature is unusual.

Splenectomy is the treatment of choice in hemolytic jaundice, particularly in children. It is preferable to perform the operation during a remission, but occasionally it is necessary to remove the spleen during an acute exacerbation. The results following splenectomy are good in a high percentage of cases. Splenectomy is not always necessarily indicated in adults.

Rupture.—Richey L. Waugh and John A. Prior[3] (Boston) discuss *traumatic rupture of the spleen followed by delayed hemorrhage* with particular reference to the complication of rib fractures on the left side. A critical review of the literature reveals 68 cases which fulfil the criteria of McIndoe. Two additional cases are reported, both complicated by rib fracture on the left side, bringing the total reported cases of splenic rupture with delayed hemorrhage to 70 and the total complicated by rib fracture to 18, or 26 per cent.

It is reasonable to conclude that in traumatic rupture of the spleen, with or without delayed hemorrhage, a considerable number of associated rib fractures on the left side are overlooked. This is due, no doubt, to attention being focused on the more important intra-abdominal traumatisms and the failure to have roentgenograms made in all such cases. Because of this frequent association, it would seem wise to bear in mind the possibility of splenic rupture with delayed hemorrhage in all patients with rib fractures on the left side.

During the so-called latent or silent period the diagnosis of splenic rupture is most difficult or impossible.

(3) Surgery 14: 1, 5-133, July, 1943.

and death may result from delay in operation Close observation during this period is essential Onset of delayed hemorrhage is usually abrupt and followed by the classic signs of primary rupture, i e , shock, abdominal pain, tenderness and rigidity

The treatment is always surgical splenectomy being the operation of choice Removal of the spleen does not produce any ill effects In some instances leukocytosis and lymphocytosis have been reported for transitory periods up to six months

Attention is called to the autoplastic transplantation of splenic tissue within the peritoneal cavity following splenectomy for traumatic rupture of the spleen These implants have been observed by several authors and were designated as "splenosis" apparently they are more likely to occur in young individuals who survive traumatic rupture of the spleen Autoplastic transplants of splenic tissue within the peritoneal cavity assume very likely, along with other lymphatic tissue of the body the function of the absent spleen However, the possible relationship between these autoplastic transplants and the disappearance of the leukocytosis and lymphocytosis is not definitely known In this connection attention is called to some invertebrates in which the splenic tissue is not collected into a definite organ but is found scattered beneath the serous coat of the gastro intestinal tract

Edward J Zabinski and Henry N Harkins[2] (Henry Ford Hosp) report four cases of *delayed splenic rupture* and present an analysis of the 177 cases available in the literature This total does not represent the true frequency of the condition Traumatic rupture of the normal spleen is the most common serious subcutaneous abdominal injury Delayed splenic rupture represents about 14 per cent of all splenic ruptures This syndrome

(2) Arch Surg 46 186 13 February 1943

is especially insidious and treacherous because of the almost symptom free latent period, but the delay offers an opportunity for diagnosis and treatment

Delayed splenic rupture is most common in males in the third decade of life Falls and traffic accidents are the most frequent etiologic agents About 50 per cent of secondary ruptures occur after an interval of less than seven days, while in an additional 25 per cent the latent period ends during the second week Fractured ribs on the left side occur in about 10 per cent of the cases, while Kehr's sign (pain in the left shoulder due to irritation of the phrenic nerve) is present in about 28 per cent or more Other diagnostic aids include those used in diagnosing any type of splenic rupture, such as sudden collapse or shock, rapid or increasing pulse rate progressive anemia, 12 000 20,000 white cells, absence of temperature over 99 F, pain, tenderness, dulness and rigidity in the left upper quadrant and, in some instances, signs of free fluid in the peritoneal cavity

Without operation, the mortality ranges from 77 to 100 per cent At the time of McIndoe's review (1932) it was 27 per cent, but during the past decade it has been only 10 per cent When splenic laceration is suspected the patient should be kept in bed under close observation In more definite cases or at the first sign of secondary hemorrhage splenectomy should be performed Adequate treatment of shock with plasma or whole blood forms a necessary adjunct to the operative procedure

Since this article was written W H Bueermann has reviewed the subject and published two additional cases [this YEAR BOOK following article]

Latent Period and Delayed Hemorrhage Following Traumatic Rupture of Spleen—W H Bueermann[3] (M C U S N R) reports two cases of traumatic rupture of the spleen with delayed hemorrhage 38 and 4 days,

(3) U S Nav M Bull 41 73 93 January 1943

respectively, after the original injury and one case of spontaneous rupture with probable delayed hemorrhage Clinical progress in the last case suggested the possibility of chronic splenitis dating from previous malarial, intestinal and osteomyelitic infections The patient's occupation required considerable climbing and stooping Autopsy findings in the spleen suggested an older hemorrhage with an adherent, partially organized clot on



Fig 219 —Case 1 Crescent shaped organized clot overlying capsul -denuded area of spleen on convex surface

the upper surface, with its outer surface smooth and the splenic surface assuming the same granular surface contour as the capsuleless spleen surface against which it was lying Whether the additional slight trauma of examination on admission, together with the activity of transportation released the secondary terminal hemorrhage after a previous latent period will remain obscure, however, it may be assumed that there had been a latent period between the initial hemorrhage and the subsequent secondary hemorrhage which caused rapid exsanguination and death before a definite diagnosis could be made

It has been established beyond question that the appar

ently normal spleen is subject to spontaneous rupture under certain conditions, such as malaria, typhoid and some infectious states One of the most dramatic of all intra abdominal injuries seen by the surgeon is that of splenic rupture due to direct or indirect injury About 500 such cases have been reported in the medical literature since the fifteenth century

The problem of delayed hemorrhage following a variable latent period dating from the time of primary injury to the spleen has been of relatively recent interest Proper recognition of this silent interval has aided in adequate treatment and in lowering mortality in this group of injuries McIndoe s series constitutes a selected group representative of the two cases cited Pain in the region of the spleen was the complaint in almost all his 46 cases It varied from mere discomfort to dull ache in the less severe cases and to intense stabbing paroxysmal pain in the more severe ones In only one instance did the patient complain of pain radiating to the left side of the neck and shoulder In case 2 of the present series this radiation was present subjectively and objectively Abdominal rigidity, generalized at first but more often localized to the epigastrium or to the left upper abdominal quadrant was the most frequent sign encountered Rigidity in abdominal contusions not limited to the injured point is of paramount diagnostic significance and is a clear indication for immediate laparotomy

McIndoe considered that the latent period began with cessation of splenic bleeding and was terminated by the sudden onset of secondary bleeding at a date remote from that of the primary injury The swift appearance of the signs of internal bleeding does not coincide with onset of fresh fulminating hemorrhage but represents either (1) a rapid failure of the patient's resistance against an increased hemorrhage or (2) the collapse following sudden evacuation of a constantly augmented perisplenic

hematoma into the general abdominal cavity, or (3) a sudden explosive rupture of the splenic capsule from a gradually augmented intrasplenic hematoma with slowly rising intracapsular pressure

In all cases the abrupt onset of the delayed hemorrhage initiated a grave abdominal disaster, made more



Fig. 20.—Case 3 Clot removed note granular appearance of surface corresponding to granular surface of denuded splenic pulp

serious to the examining surgeon by the apparent absence of an adequate cause the difficulty in diagnosis and the fulminating character of the bleeding The shortest latent period encountered in McIndoe's series was 48 hours, the longest, 6 months Onset of delayed hemorrhage occurred most often between the third and the ninth days and rarely over 14 days Time of onset of

the secondary or delayed splenic rupture and hemorrhage apparently was not dependent on the physiologic state of expansion or contraction of the spleen Many of these patients were quietly attending to their affairs, without undue effort In others, secondary rupture took place after slight strain, defecation, leaning forward during dressing or during exercise

Absolute symptomatic silence of signs and symptoms is however, far from the rule during the interval period Many patients complain of dull, remittent pain in the left side at the site of injury A slight degree of rigidity usually persists in the left upper quadrant, provoked by the slightest examination Fever is uncommon Dulness and a feeling of doughiness in the left upper quadrant with occasional increase in splenic dulness may be a significant sign pointing to the presence of a firm perisplenic mass of clots forming a large hematoma Pain in the left shoulder referred from the splenic region was noted in several cases and is often associated with elevation of the left diaphragm

Saegesser uses the "splenic point" and exerts digital pressure between the sternocleidomastoid and the scalenus anticus muscle on the left side of the neck as a diagnostic sign He has noted that in all splenic injuries pressure at this point started violent pain in contrast with the same pressure exerted on the right side This sign is positive even when rupture of the spleen is incomplete and when a subcapsular hematoma is present with the capsule intact, when this sign is positive, splenectomy is indicated and justified

A variant of this sign was discovered by accident in Case 2 In this patient pressure over the left upper quadrant elicited severe pain in the "splenic point" of Saegesser The referred pain was severe enough to have the patient place his hand against the left side of his neck to control it It is suggested that this sign be tried

in suspected cases of splenic injury to obtain additional information relative to its diagnostic value

The various types of traumatic lesions in cases of injured spleen have been described by Blocker under the following heads (1) minor capsular tears and contusions of the pulp, (2) intrasplenic and subcapsular



Fig 221—Same case as preceding Sagittal section showing intrasplenic hematoma extending through entire depth of spleen substance

hematomas, with or without capsular rupture involving the pulp, (3) deep pulp and capsular lacerations with severe hemorrhage into the peritoneal cavity, (4) complete severance of the pedicle or detachment of large pieces of spleen tissue It is the second type of lesion that gives rise to delayed or secondary rupture The practical effect of these subcapsular hematomas is to

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result at operation or postmortem the extensive lesions of spleen frequently seen, seemingly without adequate cause to explain their presence

Treatment of choice for rupture of the spleen is splenectomy Attempts to repair or tamponade the ruptured spleen have been ineffective The left rectus incision described by Bevan and others has proved a satisfactory approach, although the wide transverse left subcostal incision described by Ruggi has received favorable acceptance The author favors the Balfour method of packing a continuous gauze roll into the cavity, superior and lateral to the spleen, by which maneuver the spleen is gradually brought forward into the incision and, in event of splenic fracture, bleeding comes under control Should the patient s condition warrant supportive treatment during the operative period, pooled human plasma may be given as a substitute for a blood transfusion when suitable donors are not immediately available Repeated blood transfusions are indicated in patients with a depleting blood loss Autotransfusion of filtered free abdominal blood may also be considered as a life saving measure if neither donor nor plasma are available, but only in cases of primary rupture of the spleen with intra abdominal hemorrhage

In confusing associated pathology, an abdominal tap may be invaluable in diagnosis

The anesthesia of choice should be the open drop ether method since spinal anesthesia in shock or in the impending shock of hemorrhage would be contraindicated

Wound healing is occasionally inhibited after splenectomy, as indicated by the rather high percentage of wound disruptions reported Maintenance of an adequate serum protein level, together with a high vitamin C dietary regimen, may do much to counteract this tendency

Of 49 cases of wounds and ruptures of the spleen re

increase enormously the area of the tensely stretched capsule, the impaired nutrition of which predisposed toward secondary rupture

The latent period is largely dependent on the degree and type of bleeding and its method of control, since the time required for hemorrhage to cease will vary with the type of injury The history of frequent recurring attacks of left upper abdominal pain, tenderness, progressive weakness, anemia and increase in left upper quadrant dulness during the latent period indicates that perhaps fresh bleeding has occurred intermittently and that the primary hematoma has been increasing in size However, when hemostasis is temporarily complete, attempts at healing may even take place during the latent period

Secondary hemorrhage, which terminates the latent period, usually occurs when the tensely stretched capsule overlying an intrasplenic hematoma gives way suddenly at that portion of the capsule, weakened by the original trauma, which has been softened by surrounding inflammatory changes and interference with its trabecular blood supply In such cases bleeding once restarted becomes profuse and rapidly uncontrollable except by splenectomy

Many of the reports from the literature record the fact that ruptures found at operation and necropsy were much larger and more extensive than could have been inflicted by the original injury It would thus seem that the episode of secondary hemorrhage occurred with such a degree of violence that it had a shattering and disintegrative effect on the spleen, so intense at times as almost to sever the spleen from its pedicle as well as to disrupt the intrasplenic integrity Whether this phenomenon occurred as a sudden explosive effect or following a gradual course is difficult to evaluate One may even state that a much smaller initial and often forgotten primary injury to the spleen may have as its end

Occasionally, the perisplenic bleeding results in tenting of the diaphragm, which is an additional valuable sign Three illustrative cases are reported

Of *methods for controlling hemorrhage from the spleen* by ligation of the splenic artery proximally, that described by Miller is the most recent He exposes the artery near its origin and uses a temporary tourniquet All methods of this type presuppose a clear field and

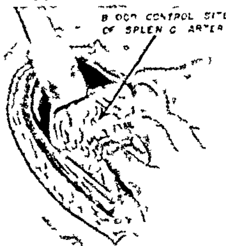


Fig 222 —Site of splenic hemorrhage

sufficient time to carry out that dissection In extensive hemorrhage, these methods are not feasible, therefore Walter S Levenson and Alfred Hurwitz[4] (Harvard Univ) describe a simple, effective and quick procedure and report two cases

TECHNIC—With the abdomen open, the stomach is drawn down and to the left by traction with the hand along the lesser curvature This enables one to palpate the splenic artery and apply direct pressure against it at its origin in the celiac axis (Fig 222) For tampon, a sponge rolled into a firm ball and held in a large Ochsner clamp is used by the assistant This instrument takes up so little space that it does not hamper the surgeon

(4) Am J Surg 58 1"3 1 4 October 194"

ported from the A E F during World War I, two thirds showed complicating lesions (varying from perforating wounds to complete avulsion of the spleen and multiple fracture), the operation of choice was tamponade, since splenectomy was quoted as giving practically a 100 per cent mortality The mortality rate in all cases was 62 3 per cent

[One of the principal dangers associated with rupture of the spleen is the false sense of security which is sometimes caused by temporary improvement of the patient after the use of conservative measures. Sometimes the patient will do well for 10 days or 2 weeks and then have a fatal hemorrhage when he gets out of bed and begins to move around. If a rupture of the spleen is even suspected it is wiser to operate with the idea of performing splenectomy than to hope that the patient will recover without operation —Ed]

Roentgen Diagnosis of Lacerated Spleen —In a survey of 100 flat plates of the abdomen of persons without splenomegaly, Leon Solis Cohen and Samuel Levine[4] (Philadelphia) observed that the spleen can often be delineated fairly well in the left upper quadrant When the stomach is distended with air, the splenic shadow may be discerned with great clarity but the greater curvature of the stomach retains its normal convexity

In lacerations of the spleen there is obliteration of the splenic shadow This may be due to intracapsular splenic hematoma or perisplenic hematoma In addition to hemoperitoneum the blood gravitates along the gastrosplenic ligament and infiltrates in juxtaposition to the gastric wall This results in a jagged serrated greater curvature The extent of serration and deformity of the gastric contour is directly proportional to the degree of hemorrhage When the latter is pronounced, there is associated reflex gastric dilatation The finding of a dilated stomach along with serration of the greater curvature is doubly significant and lends further proof to a specific diagnosis of lacerated spleen

(4) Radiology 9 70 10 December 1942

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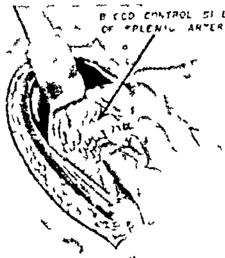


Fig 2?? —Site of splenic hemorrhage

sufficient time to carry out that dissection In extensive hemorrhage, these methods are not feasible, therefore Walter S Levenson and Alfred Hurwitz[4] (Harvard Univ) describe a simple, effective and quick procedure and report two cases

TECHNIC —With the abdomen open, the stomach is drawn down and to the left by traction with the hand along the lesser curvature This enables one to palpate the splenic artery and apply direct pressure against it at its origin in the celiac axis (Fig 222) For tampon, a sponge rolled into a firm ball and held in a large Ochsner clamp is used by the assistant This instrument takes up so little space that it does not hamper the surgeon

(4) Am J Surg 58 123 1?4 October 194

Cysts—Richard H Sweet[5] (Harvard Univ) reports three cases of *single true cyst of the spleen*

Splenic cysts are rare and may be grouped as true and false depending on whether or not they are lined by a specific secreting membrane Of 137 cases collected from the literature by Fowler, 21 per cent belonged to the first group

Diagnosis is difficult when the cysts are small but can be readily made when they are large A dull dragging pain or discomfort in the left upper abdominal quadrant may be present There is always a large abdominal tumor occupying this quadrant, it extends into the lower part of the abdomen and toward the right side the extent depending on its size The left costal margin is usually pushed outward by the tumor, which always extends beneath it A definite fluid wave can usually be detected

Roentgen examination of a large cyst is so typical that it may be considered diagnostic The left side of the diaphragm is high and under the fluoroscope its motion is impaired A plain abdominal plate shows a large soft tissue mass arising in the left upper quadrant In Sweet's three cases the lower pole of this shadow had a somewhat angular almost pointed contour that extended downward and to the right into the pelvis because the cyst developed in the upper pole of the spleen leaving a small, intact, triangular lower pole at the lower extremity of the tumor After a barium meal the stomach is found pushed to the right and backward The colon especially the transverse, splenic flexure and descending portions is displaced downward and to the right The left kidney is pushed downward

Splenectomy is by far the simplest and safest procedure and should be adopted in all cases its mortality is not over 4 per cent The normal relations of the viscera that were displaced by the tumor are rapidly restored

(5) New England J Med 228 705 710 June 3 1943

A calcified, nonparasitic cyst of the spleen was found in a case by A Elkeles[6] who makes the following report

Man, 41, complained of pain in the left hypochondrium, which was worse after meals and exercise and had been present off and on for 14 weeks For a number of years he had had attacks of vomiting after meal There was no history of injury A large mass filled the left hypochondrium passing toward the umbilicus and moving on respiration Roentgen examination showed a large round calcified cyst which pushed the left diaphragm upward, the stomach to the right and the splenic flexure and left kidney downward The spleen was removed, and convalescence was uneventful The cyst was at the upper pole of the spleen, and its wall was almost completely calcified It contained a brownish opalescent fluid, suggestive of cholesterol crystals, confirmed by microscopic examination which also showed fatty material and occasional red cells and leukocytes The wall of the cyst had adherent brownish red clot, evidence of old hemorrhage

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SPINE AND CORD

Spine—*Fractures and fracture dislocations of the cervical spine* have a disconcerting tendency to recur after reduction if traction is replaced too soon by a collar, particularly in forward dislocations, crush fractures with dislocation and fractures of the laminae F R Hook and Robert Mazet, Jr[5] found Crutchfield tongs satisfactory in nonoperative cases But to give the patient the advantages of ambulation, they devised an appliance which was used in two cases with satisfactory results

Ambulatory Traction Apparatus—This consists of a steel strap, 1 × ⅛ in bent to fit the contours of the body and incorporated in a plaster of paris jacket The strap extends up over the head so that the tongs can be secured to it It was made from a walking iron, bent as in Figures 223 and 224 with several holes drilled in the top end to secure the tongs

(6) Brit J Radiol 16 59 60 February 1943
(5) U S Nav M Bull 41 07-13 January 1943

and three crosspieces fixed to the bottom end to insure firm anchorage in the jacket A short coiled spring is inserted between strap and tongs to take up the slack incident to variations in tension produced by changes in position To maintain

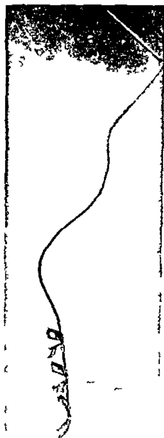


Fig 223 —Side view of ambulatory traction device before incorporation in plaster jacket

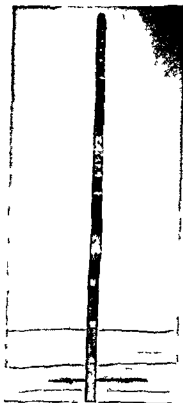


Fig 224 —Same device front view

position, the jacket must be brought up on the neck posteriorly as high as possible and over the shoulders to secure firm fixation of the bar, and the iron must be strong and not too springy (Fig 225) If these precautions are not observed,

hyperextension and reduction cannot be maintained Constant vigilance to see that hyperextension is not lost is necessary

The authors do not advocate this as routine, but they feel that it has its place when evacuation is necessary, or prolonged immobilization is indicated and reduction cannot be maintained in a plaster collar, and in elderly

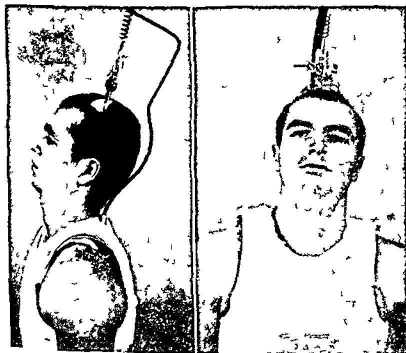


Fig 225 (left) —Patient wearing ambulatory traction device
Fig 226 (right) —Same patient

or plethoric individuals when prolonged recumbency is contraindicated

Spina bifida in binovular twins is reported by A Fry[6] (South Norwood) Spina bifida in twins is rare but its occurrence in binovular twins has not been described

Healthy woman, after normal pregnancy and at term, gave birth to male twins The first infant had an open spina bifida (without sac) in the lower dorsal and lumbar region, 2¼ × 1¼

(6) Brit M J 1 131 13 Jan 30 1943

in, with hydrocephalus showing separation of the bones of the vault of the skull The second had a spina bifida without sac in the lumbar region $2\frac{1}{2} \times 1\frac{1}{2}$ in, the head was normal size There was some leakage of cerebrospinal fluid in both infants, who lived 35 and 36 hours, respectively There were two separate placentas which looked normal, and two chorionic sacs There was no family history of twins or congenital abnormalities, and no history of maternal trauma during pregnancy

Spina bifida is described as a condition in which coalescence of the lamina is not completed a cleft is left in the arches of the vertebrae, through which protrusion of the spinal meninges (dura and arachnoid), and generally of spinal cord, takes place It is commonest in the lumbar and sacral regions Incidence is 1 in 1,000 births A sac may be present or absent, in the latter case there is leakage of fluid which is incompatible with life Spina bifida is often associated with congenital hydrocephalus

The only case of spina bifida in uniovular twins was reported from Norway by Eskelund and Bartels (1941) The dizygotic origin of the twins in the present case is certain This case tends to support the theory that the cause of spina bifida is primarily a defect in development of mesoblastic tissues from which the spinal meninges are produced as this is the only factor likely to involve equally the two separate ova rather than the mechanical agent or the external influences mentioned in various theories advanced

Migration of foreign bodies is discussed by Lambert Rogers (Univ of Wales) and a case reported

Gunner, 21 had persistent pain in the lower part of his back and in the legs Roentgen examination revealed the eye end of part of a sewing needle lying inside the spinal canal behind the body of the fifth lumbar vertebra (Fig 227) Inquiry elicited that while he was rolling on the floor at the age of 4 a sewing needle had entered his back and broken off Two attempts to remove the embedded part at the time had failed At operation, the piece of needle was found lying among the

( ) Lancet 235 936 Nov 194

elements of the cauda to the right of the midline and covered by a thin film of arachnoid It was encrusted with rust and old blood clot and was easily removed Recovery was uneventful, and the patient returned to duty symptom free

Rogers cites various authentic cases of migration of foreign bodies Migration of pins and needles, independently of the blood stream, is not easy to understand There is no doubt that many such foreign bodies remain at their site of lodgment for long periods, but the few examples cited show that migration occurs occasionally Thus, it is permissible to conclude that pins and needles



Fi —Anteroposterior and lateral vie s f eye end of piece of sewing needle in spinal canal

(1) may remain fixed at their site of lodgment, (2) rarely travel as emboli in blood vessels and (3) rarely travel either through the subcutaneous tissues or along fascial or intermuscular planes for varying distances Migration in general seems to be toward the trunk i e, in a proximal or centripetal direction and toward the surface

Olan R Hyndman, Arthur Steindler and Julius Wolkin (State Univ of Iowa) analyzed 63 cases of laminectomy for *herniated intervertebral disk* in which iodized poppy seed oil studies were made and in 50 of which herniated disks were found at operation Having become thoroughly acquainted with the important features of the iodized oil column they decided to use the

( ) J A M A 1 1 390 401 Feb 6 194

method only in the occasional case in which such precise confirmation is desired Since then, they have done 26 additional laminectomies 17 were done without confirmation by iodized oil, and in only 1 was the lesion not found Iodized oil was used in nine the films were positive in six and disks were found, they were negative in two in which herniated disks were not found, and considered negative in one in which a small disk was found

This study shows that low back pain accompanied by sciatic radiation may be due to lumbosacral root compression A herniated intervertebral disk is the commonest causal factor Pain is referred and is ordinarily accompanied by other symptoms and signs of nerve root compression that are of diagnostic significance If a tender locus is present over the lower part of the back sacrum or buttocks, local anesthetization of the locus will not abolish symptoms or signs The pain may also be due to myofascial trauma The radiating pain is reflected and unaccompanied by symptoms and signs of spinal root compression If a tender locus (trigger point) over the lower part of the back, sacrum or buttocks is present, local anesthetization (procaine test) will abolish the pain temporarily and thus indicate the causal factor Hence the procaine test is an additional valuable test in the differentiation of referred and reflex "sciatica"

Herniated intervertebral disk below the fourth or fifth lumbar vertebra ordinarily invokes such a definite syndrome that myelography is seldom necessary to establish diagnosis In the occasional equivocal case in which myelography is desired, iodized poppy seed oil is the medium of choice If 5 cc oil is used, the smallest, laterally placed herniations will be indicated in the roentgenogram in a high percentage of cases

In a small percentage of patients who present definite symptoms and signs of root compression, including ab

sence of Achilles tendon reflex, no herniated disk, concealed or otherwise, is found. In this type the authors advise complete removal of the fourth and fifth lumbar laminal arches and their accompanying ligamenta flava and partial unroofing of the intervertebral canals of the fifth lumbar and first sacral roots. Results following such a decompression have been encouraging.

The conditions of a positive procaine test are (1) The case must be suitable for the test by showing a definite trigger point at the back and sciatic radiation (2) Insertion of the needle must increase the local pain as well as the radiation (voluntary information) (3) Injection of procaine must abolish the local trigger point as well as the radiation, and the Kernig sign must disappear (voluntary information) (4) Precautions should be taken against any autosuggestion by the patient (5) The procaine test should not be accepted as proof unless it is strikingly positive.

In regard to treatment, a positive procaine test promises success of immobilization. In most cases conservative immobilizing measures suffice (traction, plaster, brace cast), however, in some cases operative fixation (fusion) is necessary. In cases of strain of the fascia lata (positive Ober sign and tender point at fascia), the Ober operation is successful. Physical therapy in the form of hot packs, massage and graded exercises is an essential adjuvant to treatment.

Unilateral rupture of the sixth cervical intervertebral disk produces a syndrome characterized by pain in the neck which radiates to the shoulder, precordium and arm and by sensory changes in the index and middle fingers. R. Eustace Semmes and Francis Murphey[8] (Univ. of Tennessee) report four cases. Diagnosis can be made more accurately by clinical means than by use of contrast mediums. The operation of choice is subtotal hemi

(8) J A M A 121 1209 1214 Apr 10 1943

laminectomy under local anesthesia Localization of the lesion can be verified at operation before removal of any bone

Hypertrophic arthritis and/or narrowing of the intervertebral disk seldom causes nerve root pressure Rupture of any intervertebral disk may result in hypertrophic changes on the edges of the adjacent vertebrae

The degree of sensory change in the index finger which results from compression of the seventh cervical nerve root is more pronounced than that produced by interruption of any other single spinal nerve root The pathway over which pain radiates to the precordium has not been ascertained

An undetermined number of patients who heretofore have been thought to have coronary occlusion angina pectoris hypertrophic arthritis of the cervical spine neuritis of the brachial plexus bursitis scalenus anticus syndrome or cervical rib have rupture of one of the lower cervical intervertebral disks

Samuel S Hanflig[9] (Boston) points out that *pain in the shoulder girdle arm or precordium may be due to foraminal compression of a cervical nerve root* Diagnosis is suggested by pain uninfluenced by motion of the shoulder and definitely related to motion of the neck Pain is usually made worse by anything that increases intrameningeal pressure such as coughing sneezing and defecation The condition responds to overhead suspension traction or to traction in bed, this response is a distinct diagnostic aid

The apparatus for overhead suspension traction is a collapsible portable tripod (Fig 228) A simple but substantial overhead hook or beam to which a set of pulleys and ropes can be secured is equally effective Traction is usually carried out by the physician Once intelligent patients have become familiar with the technic they

(9) Arch Surg 46 [illegible] 1943

can carry out the treatment at home Traction will relieve patients of most of their pain in 4 to 7 days, after which there is gradual disappearance of the residual pain through a week to 10 days The patient is lifted for a moment or two and then lowered This is repeated for



Fig 9 8—Patient seated in portable apparatus for overhead suspension traction

two to three minutes and constitutes one treatment period The treatment is followed by an application of heat and massage to the neck muscles The average case calls for three stretching periods on each of the first two days, two on each of the next two days, and then they are spaced out as needed

For patients who have become difficult to handle be cause of long standing pain and for others who prefer bed and hospital care, traction in bed is a good substi tute It can be carried out effectively in a cardiac bed by using its tilting mechanism, or by elevating the head of the conventional bed on blocks or a chair Traction is maintained by use of 5 lb on each arm of the Sayre sling or by a 10 lb weight if one uses a cross bar to allow the patient to turn from side to side while maintaining traction Traction is continued for 2 hours, after which the patient is allowed a rest of 20 minutes This pro cedure is carried out alternatingly throughout the day Recovery with this type of traction is slower than with the overhead type

Cord—*Anterior sacral meningocele* is a rare condition which is important only because of the symptoms it may produce and because, if unsuspected, misdirected treat ment may lead to meningitis The literature reveals 22 cases In 18, the patients were treated, with a mortality of 44 per cent Eight were cured, including a case re ported by Frederick A Coller and Richard G Jackson[1] (Univ of Michigan) in a woman 22, whose tumor was the size of a grapefruit

Anterior sacral meningocele usually manifests itself within the first three decades It occurs more frequently in females than in males the ratio being 20 3 The youngest patient was 3 months the oldest 36 years The meningocele enters the pelvis through an anterior sacral defect which is usually laterally placed and occurs more

(1) Surg Gynec & Obst 76 703 707 June 1943

often on the right than the left side However, the tumor may herniate through the sciatic foramen and present posteriorly The complaint is usually constipation, although in one case dysmenorrhea and increase in length of menstrual periods were noted Diagnosis is suggested by a history of lifelong constipation, palpation of a fluctuant retrorectal tumor and x ray demonstration of



Fig 229 —Anteroposterior view of pelvis shows appearance of sacrum

deformity of the sacrum (Fig 229) Treatment should be conservative unless symptoms become severe or danger of the meningocele complicating pregnancy arises Operation consists in exposing the tumor, ligating and sectioning its pedicle It is not necessary to excise the wall of the sac because it does not secrete spinal fluid It seems better to approach the tumor through a posterior midline than an abdominal incision because it can be more easily visualized in this manner and there is

the added advantage that it is attended by less danger of damaging the great vessels pelvic organs or ureters

Robert L Craig (Duke Univ) reports a case of subpial *epidermoid tumor of the spinal cord* in the lumbosacral region (Fig 230) The peculiar histologic appearance of the tumor in which the basement epithelial membrane is thrown up into innumerable folds, possibly accounts for the unsatisfactory surgical result which was obtained Inclusion cysts developing in relation to the spinal cord and its meninges are rare Three distinct types are recognized (1) epidermoid or cholesteatoma, containing only epidermal tissue and its debris, (2) dermoid containing in addition, dermoid structures and derivatives and (3) teratoma containing tissues derived from two or more germinal layers

Craig reviews the literature of epidermoid and dermoid tumors of the vertebral canal using as a basis the reported cases collected by Boldrey and Elvidge in 1939 Revision of this collection by eliminating doubtful cases and adding others including the present one brings the total to 43 of which 20 are probably epidermoids and 23 probably dermoids

In general epidermoids and dermoids behave much as do other types of spinal tumor in similar locations Certain aspects of their symptomatology deserve special mention In epidermoids, sterile inflammatory reactions such as meningitis and acute transverse myelitis occasionally occur There is some evidence that these are due to fatty acids formed within the cyst and liberated into the subarachnoid space Dermoid tumors are occasionally associated with congenital dermal (pilonidal) sinuses Obstruction of such a sinus may result in sudden exacerbation of pressure symptoms Infection reaching the meninges via these sinuses may give rise to septic meningitis or localized subdural abscess

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( ) Surgery 1 [illegible] 4 3[illegible] March 194[illegible]

Preoperative recognition of these tumors is not always possible, but history of symptoms beginning early in life finding of a cutaneous dimple or a discharging sinus in the midline of the back or presence of spina bifida corresponding to the involved segment of the spinal cord

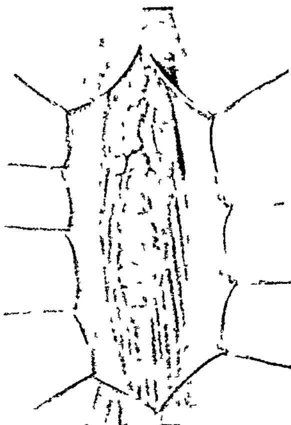


Fig 30 —Operative field after retraction of dura Main body of the tumor lies in the conus covered only by a thin membrane of pia arachnoid

should suggest that one is dealing with a congenital cystic tumor of epidermoid or dermoid type

G S Baker[8] reports two cases of *lymphoblastoma of the spinal cord simulating other organic diseases* The

(8) Proc Staff Meet Mayo Clin 17 588 599 Dec 9 1942

tumor is uncommon and must be considered as bizarre in production of localizing painful effects, since it originates extradurally and usually infiltrates along the peripheral nerve roots It is not until the first symptoms of compression of the cord are noted that attention is focused on the primary lesion

CASE 1 —Man, 49, had several attacks of severe pain in the left side of the abdomen for five years After pain disappeared he always felt well No definite diagnosis could be made, but possibility of a mechanical lesion and of pancreatic stone was considered With the last attack, paresthesia of the right calf and posterior portion of the thigh developed Then pain in the right calf appeared on walking and gradually became more severe, involving the entire leg It was especially severe at night and was accompanied by some muscular spasm. Neurologic examination revealed absence of patellar and diminution of achilles reflex on both sides but more marked on the right He walked with a limp and favored the right side Lasegue s sign was positive on the right Sneezing and coughing caused the pain to extend down the right leg along the sciatic nerve Possibility of a protruded intervertebral disk was considered Roentgen diagnosis was tumor of the cord at the level of the second and third lumbar vertebrae When the right lamina of these vertebrae was removed, a large extradural tumor was found It had grown mainly on the right side of the cord but had also gone beneath the nerve roots into the anterior portion of the spinal canal All of the mass that could be seen was removed and good decompression carried out The pathologist reported lymphosarcoma Postoperative course was uneventful Two courses of roentgen therapy after discharge completely relieved symptoms

CASE 2 —Man 41 had overexerted himself four months previously and rapidly developed symptoms attributed to acute coronary occlusion Two months before admission both feet suddenly became numb and muscular weakness appeared Anesthesia and muscular paralysis reached the nipple line in 24 hours but for about a week he could move his toes a little Two days after onset of anesthesia and paralysis, he developed difficulty in coughing Roentgen examination suggested a spinal cord lesion at or near the level of the third thoracic vertebra and left thoracic laminectomy was decided on On exposing the spines and laminae of the second to fourth vertebrae, an infiltrating cellular tumor was found which had invaded and

bound together the dura, epidural fat and ligamenta flava Gross appearance was not unlike that of an extensive chronic inflammatory process Several small pieces were removed for examination before the wound was closed The pathologist reported lymphoblastoma Postoperative course was uneventful, and the patient was to receive roentgen therapy Outlook for return of function of the extremities is poor, as the lesion produced transverse myelitis, and blood supply to the cord was interrupted

Two Needle Oxygen Myelography—Donald Munro and Charles W Elkins[9] (Boston) prefer oxygen because it is nonirritating, self eliminating, inexpensive and universally available and because it cannot be made to serve later as an excuse for prolongation of symptoms or initiation of litigation by the patient With a two needle technic for introduction, its distribution can be so controlled as to permit filling all or any part of the spinal subarachnoid space, oxygen can be used repeatedly in the same patient without jeopardizing the accuracy of later studies of the chemical constituents of the cerebrospinal fluid

TECHNIC—One oz of castor oil by mouth and a soapsuds enema are given the evening before the procedure With the patient in the lateral position on a tilt top roentgen table with a Bucky Potter diaphragm, a low lumbar puncture is performed, followed by another puncture at the desired cephalad level of fill No 18 gage Fremont Smith needles with three way stopcocks are used for the punctures Simultaneous pressure readings from water manometers are taken from the needles The Queckenstedt block test is done with a blood pressure cuff around the patient's neck to compress the jugular veins rather than by relying on digital pressure

Two cc of spinal fluid is removed from each needle for protein determinations and cell counts The patient's head is then lowered to 25 degrees below horizontal, and both needles are opened Fluid will flow from the cephalad needle and as this occurs, oxygen is slowly injected into the caudal needle from a sterile 50 cc syringe Care is taken not to inject the gas under pressure When spinal fluid ceases to flow from the cephalad needle and oxygen appears both needles are closed

(9) Surg Gynec & Obst. 75 729 736 December 1942

Stereoscopic lateral roentgen films are taken of the lumbar and thoracic levels Oblique views are used and satisfactorily replace both the lateral and the anteroposterior views in the cervical level however As little delay as possible should occur between the time the injection is completed and the x ray films are exposed because the gas tends to absorb quite rapidly in some cases To avoid this complication, the needles are left in place while the lateral views are taken After these are completed both needles are again opened and more oxygen is injected The needles are then withdrawn, the patient is quickly turned on his back and stereoscopic anteroposterior and oblique films are taken From 20 to 30 cc oxygen is sufficient to fill the lumbar area 40 50 the midthoracic and lumbar areas and 75 100 the entire spinal canal

The technic with which the roentgenograms are taken is of great importance When finished, the films should be black and white, not gray Gray films dull the outline of the air column and prevent intelligent interpretation The tube must be calibrated for setting, distance and basic kilovoltage The tube used by the authors has a distance of 30 in the setting being 50 ma for all exposures while the kilovoltage varies with the thickness of the patient It is essential, therefore, to measure the patient for each set of exposures, refer this measurement to the calibration chart for the basic kilovoltage needed by the particular tube in use and then because of the need for contrast films, to add 8 kv to the basic figure to get the actual kilovoltage required

The authors present evidence as to the general usefulness and accuracy of the method as a diagnostic aid

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UPPER EXTREMITY

Postoperative (Anesthetic) Paralysis of the Brachial Plexus—Edwin G Clausen[2] (Univ of California) reports nine cases occurring in patients while on the operating table

Abnormal positions (Fig 231) associated with complete relaxation result in abnormal tension on and stretch of the brachial plexus The anatomic factors in

(2) Surgery 12 933 942 December 194

volved are lateral deviation and hyperextension of the head, the first rib, the clavicle, the arch formed by the coracoid process of the scapula and the tendon of the pectoralis minor muscle, and the axillary prominence of the head of the humerus

Certain fundamental principles are emphasized With

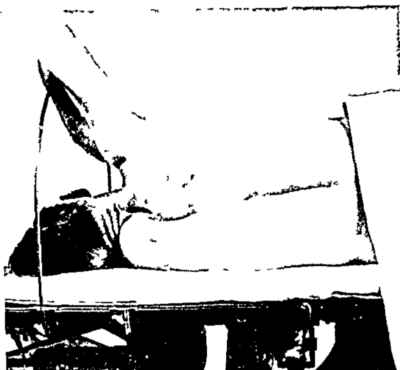


Fig. 1.—Position commonly used for thoracic procedures which resulted in injury

the patient in the Trendelenburg position and the shoulder depressed the arm should be left at the patient's side When the arm is abducted the head and neck must be held in neutral position or adducted The arm should never be abducted beyond 90 degrees under any circumstances The arms must not be abducted and extended above the head when the patient is in the supine

or the prone position Shoulder braces must be adjusted before the Trendelenburg position is assumed, they should be well padded and adjustable in height as well as in width Wide separation of the head and shoulders must be avoided Movement of an anesthetized patient must be attended by adequate personnel

The possibility of this unfortunate complication must be kept in mind by every member of the operating room staff

Samuel Standard[3] (Montefiore Hosp, New York City) discusses a case of *lymphedema of the arm following*

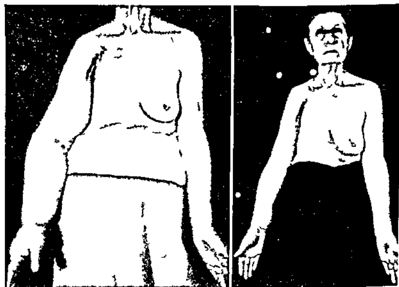


Fig 282 (left) —Arm nine years after mastectomy for carcinoma of breast. Fig 233 (right) —Same patient 12 months after operation

radical mastectomy for carcinoma of the breast (Figs 232 and 233), in which he excised an oval segment of skin and deep fascia exposing bare muscles on the medial aspect of the arm The skin of the chest wall opposite this segment and the deep fascia were incised, exposing the serratus anterior and the skin edges of the

(3) Ann Surg 116 816 820 December 1942

arm and chest were sutured with interrupted silk The arm was immobilized against the chest wall by a snug bandage The postoperative course was uneventful The patient now can attend to all her wants, her only limitation being that of abduction of the arm, which is loosely chained to the chest wall Adequate return lymphatic flow from the arm evidently takes place through the chest wall

A second operative method, with this principle in mind is a plastic procedure in which the flap could be swung from the back across the axilla and down the arm This would supply the alternate route for venous and lymphatic return without fixing the arm to the chest

Shoulder—C Laird Wilson and G Lyman Duff[3] (McGill Univ) made a *pathologic study of degeneration and rupture of the supraspinatus tendon* which, with the tendon of the long head of the biceps muscle, was examined in both shoulders in an unselected series of 125 bodies

The average lengths of the supraspinatus tendons on both sides were the same Normal growth accounts for the increase in length observed from infancy to adult age A tear of the innermost fibers of the tendon which includes the joint capsule (rim rent) gives an apparent increase in length of the tendon and occurs most often and is most severe, if bilateral, on the side which has had greater use, i e , the right side

The frequency of rupture of the supraspinatus tendon increases with the age of the group examined The incidence of complete rupture among 108 unselected bodies over 30 was 22 2 per cent, and the average age was 65 The incidence of partial rupture among 74 unselected bodies over 30 was 20 per cent and the average age was 62

Complete rupture of the supraspinatus tendon occurs

(3) Arch Surg 47 121 135 August 1943

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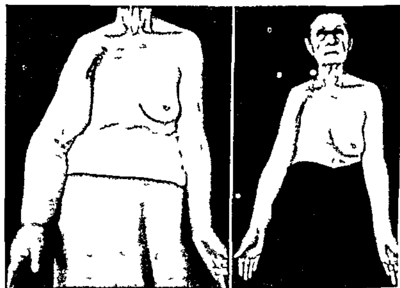


Fig 232 (left) —Arm nine years after mastectomy for carcinoma of breast. Fig 233 (right) —Same patient 12 months after operation.

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(3) Ann Surg 116 816 8?0 December 194?

The degenerative process occurring in the supraspinatus tendon and the tendon of the long head of the biceps muscle probably occurs in varying degrees in similar structures in other parts of the body. This suggestion is supported by comparison of the known data concerning degeneration and rupture of the supraspinatus tendon with the equivalent data regarding rupture of the tendinous ring of the intervertebral disk.

In 18 months, Gene D. Caldwell[4] (M.C., U.S.A.) *treated complete permanent acromioclavicular dislocation by surgical arthrodesis* in three soldiers. Sufficient time had elapsed at the time of this report to show results in two of these cases.

All three complained of pain, weakness of the shoulder under heavy stress and inability to carry a pack or rifle because of pain incident to pressure of the pack strap or rifle on the upward riding clavicle. It was felt that to render the soldier fit for full military duty, the corrective treatment must fulfil three requirements: (1) the shoulder must be absolutely stable under any stress, (2) it must be painless under all conditions, and (3) there must be no serious impairment of motion.

Complete failure of fascial repair of the ligaments in the first patient prompted an attempt at surgical fusion of the acromioclavicular joint. This would certainly produce absolute stability and eliminate pain and would probably not produce serious impairment of motion or disability.

TECHNIC.—The acromioclavicular joint is exposed through an anterior curved incision, a flap being reflected posteriorly to expose the distal end of the clavicle and acromion. All articular cartilage is completely removed from the opposing joint surfaces, and the raw bone surfaces are brought into apposition and secured by a vitallium screw driven from the tip of the acromion through the acromion and into the cortex of the clavicle. Internal fixation is considered unnecessary to maintain complete immobilization of the joint while fusion

(4) J. Bone & Joint Surg. 25:368-374, April 1943.

first on the side which has been called on for greater muscular use, and in bilateral rupture it is larger on that side Therefore most unilateral ruptures are on the right side and in bilateral rupture the larger defect is on the right side

Rupture of the tendon of the long head of the biceps muscle occurred in 7 4 per cent of the bodies examined It was always associated with complete or partial rupture of the supraspinatus tendon and erosion of the articular cartilage of the head of the humerus Complete or partial rupture of the supraspinatus tendon is much the most frequent, if not the only, cause of rupture of the tendon of the long head of the biceps other than severance of the tendon by a penetrating wound After rupture of the supraspinatus tendon the upper end of the tendon of the long head of the biceps muscle fuses with the capsule of the shoulder joint and is gradually obliterated while the lower end becomes attached to the bicipital groove

Weakening of the supraspinatus tendon is a necessary antecedent to rupture When a strain is applied through the bones to a specimen consisting of scapula supraspinatus muscle, tendon and humerus a normal supraspinatus tendon does not rupture Rupture occurs instead in any other part of the system

A degenerative lesion of the supraspinatus tendon is described which is characterized by alterations in tendon structure, changes in its staining qualities increase in *the number of arterioles and alterations at the insertion* of the tendon These alterations need not all be present in a given tendon but they increase with age and may all be present in high degree They are especially conspicuous in ruptured tendons It is concluded that this degenerative lesion is the cause of the weakening which permits rupture of the supraspinatus tendon Similar degenerative changes are found in the tendon of the long head of the biceps muscle

METHOD —The bed must have a firm mattress with fracture board between mattress and springs Both axillae are well padded with cotton, and a posterior figure-of eight bandage applied to hold the shoulders back The patient is placed on the back with a small pillow, 6 × 8 in, under the dorsal spine The head of the bed is raised A muslin bandage 4 in wide is slipped under the figure-of eight bandage at the involved shoulder, pulled in, up and out and fastened to the head of the bed An opiate or sleeping powder is given

The body tends to slip down in bed, especially when the patient is asleep Traction of the body against the countertraction of the bandage attached to the head of the bed reduces the fracture and maintains it in position If pressure in the axilla is uncomfortable, the patient pushes up in bed and pressure is relieved If more traction is necessary, a pulley can be fixed to the head of the bed and a rope with weights attached passed through the pulley and fastened to the shoulder loop The patient is kept in bed three or five weeks, depending on how soon healing takes place as shown by the x ray

Arm —*Early mobilization of fractures of the upper end of the humerus,* recommended by Frank Brostrom [5]

TECHNIC —After reduction, the fractured extremity is supported by an axillary pad, with the arm fixed to the side of the body by a wide bandage encircling the upper arm and body, leaving the elbow free The wrist is supported by a cuff suspended from the neck When in bed, the patient is placed with the body at approximately an angle of 35 degrees It is important that the patient at no time be placed in the horizontal position

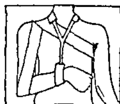
The day after the fracture, mild dry heat is applied to the shoulder elbow and hand without disturbing the bandage The fourth day after application of heat the bandage is removed with the patient in a standing position Light effleurage of the entire extremity and shoulder is administered to relieve pain and reduce swelling, and the forearm is gradually extended Following massage, the patient is instructed to flex the trunk bend the knee on the involved side and permit the arm to fall forward completely relaxed so that passive abduction and forward flexion are secured The patient now moves

(5) Arch. Surg 46 614 615 May 1943

takes place Small bone chips are raised from the adjacent clavicle and acromion and are packed in and around the joint surfaces

In the second case, internal fixation was obtained by two Kirschner wires after the vitallium screw had broken through the upper shelf of the acromion Immobilization was maintained for 11 and 9 weeks, respectively

In the first patient, scapulohumeral abduction was limited at 80 degrees and total abduction at 165, the second patient had a full free range of active and passive motion of the shoulder in all planes Several factors explain limitation of abduction present in the first patient prolonged immobilization in abduction with resultant periarticular fibrosis and adhesions, spur formation at the tip of the acromion, limiting scapulohumeral abduction, and failure of complete rotation of the scapula limiting total abduction A similar difficulty was noted in the normal shoulder Both patients are symptom free and on full duty


Fig 234

V F Masters[5] (Berkhamsted) finds the standard methods of *treatment of dislocated acromioclavicular joints* wanting and recommends using an Esmarck tourniquet as bandage in conjunction with a sling This method gives and maintains full reduction and provides a perfect functional result (Fig 234)

Fred G Hodgson[4] (Atlanta, Ga) describes *traction treatment for fractured clavicles* in patients confined to bed with other injuries or shock and in young women who wish accurate reduction without deformity or operative scar No anesthetic is required for reduction, the patient is comfortable and the wearing of a cumbersome brace or plaster cast is avoided

(5) Brit M J 1 92 Jan 2 1943
(4) South M J 35 1079 1080 December 1942

is avoided The adhesive strip is attached posteriorly and passed out over the spreader where it is divided and faced, each half passing around the forearm without adhering until, as it encircles the arm it reaches the tape posteriorly

The rope attached to the spreader is passed through the pulley on the overhead extension arm of the Balkan frame to support the forearm From there it is passed through half



Fig 35.—Double pulley traction method of humeral extension in fractures of shaft of humerus showing application and pulley arrangement (bandage and humeral sling are omitted) Lowering of back rest allows patient and apparatus to descend Rope travels through pulley system and weight is raised

the body in a circular motion so that passive circumduction of the shoulder occurs The range of motion at first is small and is gradually increased After five to seven days active motion gradually replaces passive motion Strict supervision of this treatment is essential At the end of the treatment the axillary pad and the body bandage are replaced Three or four weeks later the abduction pad and the bandage are discarded and the forearm cuff a week to 10 days later At the end of four weeks all active motion of the shoulder is encouraged Treatment is continued daily for two weeks, then three times a week for two weeks twice a week for three weeks and once a week until satisfactory range of motion has been obtained

Average number of treatments required in the cases reported was 23 The range of motion is graded as follows 0 25 poor 25 50 fair, 50 75 good, 75 100 *excellent* In 97 cases *the results obtained* were poor in 6 fair in 17 good in 32 excellent in 27 and undetermined in 15 Lack of co operation and failure to report back for treatment accounted for most of the poor and undetermined results

This method is far superior to the old method of long immobilization because no elaborate equipment is necessary patients do not need to remain in bed and are comfortable almost from the start of treatment, and pain is promptly relieved Later complications, such as stiff joints and traumatic arthritic changes are seldom seen

In treating fractures of the shaft of the humerus, Donald W Smith[6] (Miami Fla) uses a *double pulley humeral adaptation of Russell traction*

PROCEDURE —The patient is put to bed with the emergency Thomas splint in place A Balkan frame is installed and a single pulley attached to an overhead extension arm which is adjusted to allow desired degree of abduction and flexion The usual type of hand cage or spreader is applied by adhesive strips to the dorsal and volar surfaces of the forearm A spreader with one double or two single pulleys attached is fastened to the antecubital region by a felt sling or moleskin or adhesive tape With tape the tender medial aspect of the arm

(6) Surgery 13 6 CC January 1943

weight descends Merely lifting the weight allows the arm and splint to descend as the backrest is again lowered No special equipment is required It is comfortable

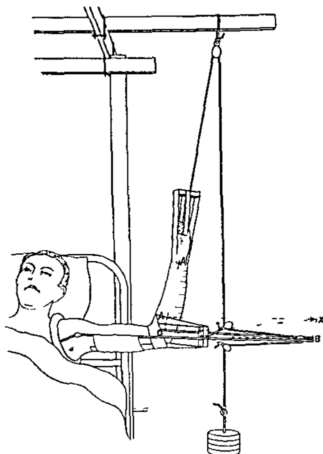


Fig 236—Superimposed parallelogram of forces *OA* equals that of the suspended weight *OB* acting through double pulley system equals twice suspended weight *OA* is portion of *OA* entering into parallelogram of forces (*A A* being neutralized by weight of the arm and hand cage) *OX* resultant of forces *OA* and *OB* lies in axis of humerus.

and adjusted with ease and no angle calculations are necessary No tilting of the bed is required, there is no loss of traction caused by the elbow spreader striking the pulleys as there may be with the usual traction stand

of the double pulley system at the elbow, then through a single pulley attached to the end of the Thomas splint and finally through the other pulley at the elbow down to the weight below In this way lateral traction and countertraction are produced to maintain humeral extension

The pulley arrangement is shown in Figure 235 Figure 236 shows a superimposed parallelogram of forces with *OA* extending from the elbow toward the single overhead pulley This force equals that of the suspended weight The force *OB*, from the elbow through the double pulley system laterally, equals twice the suspended weight When deducting the weight of the forearm and hand cage, it is found that about three fourths of the suspending force *OA* has been neutralized, leaving *OA′* as the force entering into the parallelogram of forces acting at the elbow The resultant *OX*, slightly greater than *OB*, is found to lie in the axis of the shaft of the humerus.

A 3 lb weight exerting its traction through the single overhead pulley will produce a 3 lb lift to support the arm and hardware, and through the double pulley system, it will produce slightly more than a 6 lb extension traction on the fracture site Arms requiring more or less traction also require a correspondingly heavier or lighter weight for their support By using weights from 2 to 6 lb, this system is therefore applicable to children as well as muscular adults To decrease or increase the lift on the forearm, the overhead pulley may be shifted out or in, thereby increasing or diminishing the forces involved in lateral traction A simpler method, however, is to lock the overhead pulley in the desired position by a plug or clamp

A muslin sling may be fastened over the bars of the Thomas splint to support the humerus It may be necessary to support the splint with tape to the forearm or with rope attached to or above the hand spreader

When adjustments are made, the outstanding advantage of this system over other methods of extension becomes apparent As the patient rises on the backrest the nurse gently lifts the end of the Thomas splint and the rope travels through the system of pulleys as the

possible late complication under this management, although no patients have yet manifested any symptoms

A rationale for active motion and local heat management is advanced chiefly on the following basis (1) The elbow is anatomically a multiple joint with synchronization of joint surfaces essential to function (2) The fractured fragments of the head of the radius are characteristically small and uncontrollable (3) Early active motion permits these fragments to be moved across the fixed uninjured articular surfaces of the elbow joint to attain the position where maximal function is possible (4) Use of local heat in the form of hot packs permits early elimination of soft tissue reaction and lessens the tendency, frequently seen under conventional management of calcification of soft tissues around the injured joint

W Russell MacAusland[7] (Boston) recommends *treating fractures of the olecranon by longitudinal screw or*



Fig 3 (left) —Transverse fracture of olecranon with separation of fragments.
Fig 38 (right) —Same case Fixation of fragment with longitudinal screw

nail fixation This simple procedure offers certain advantages over the suture methods in general use It allows obtaining reduction with greater accuracy and insures better retention of the fragments Good functional recovery is established within the shortest possible time

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( ) Ann Surg 110 ? 96 August 194?

Less supervision by the nursing staff is required There is no posterior angulation of the fracture when the patient is raised from the mattress for the usual nursing care, the sling attached to the Thomas splint rises with the extension system The patient may be readily transferred from Thomas splint emergency traction and may be safely transported to the roentgen department This system is adapted to skeletal traction by a wire through the distal humerus or olecranon or to modifications of skin traction as advocated by Blum and Butcher There is less force exerted on the arm for corresponding amount of axis traction than in other multiple pulley systems The single pulley force overhead is practically equalized by the weight of the arm and hardware, while the greater double pulley force corresponds with the desired axis for humeral traction Freedom of motion makes hospitalization much more bearable

Elbow—*Immediate Active Motion Treatment of Fractures of Head and Neck of the Radius*—Survey of the literature reveals that treatment of these fractures is controversial with generally not too satisfactory results James A Mason and Ned M Shutkin[6] (M C U S A) report 25 cases Seven patients were treated under conventional management with generally unsatisfactory results The remaining 18 were treated without fixation with local heat and early active motion Results as measured by comparable periods of hospitalization absence of complications and estimated percentage of function (95–100 per cent) were a distinct improvement

The classification used limits conclusions to be drawn to linear transverse or comminuted fractures of the head and neck of the radius with no or only mild displacement of the fragments Inadequate follow up precludes elimination of post traumatic arthritis as a

(6) Surg Gynec & Obst 76 7 1 7 7 June 1943

ulna If possible, it is well to so direct the screw that it engages the distal cortex of the ulna, thus providing for perfect fixation (Figs 237 and 238) If a nail is used, it must be sufficiently long so that its tip engages the cortical bone beyond the bow of the ulna (Figs 239 and 240) The lateral expansions of the triceps tendon are sutured with interrupted chromic catgut

In comminuted fractures, when the main fragments have been alined the smaller ones are easily fitted into place In the case of fractures of the olecranon associated with displacement of both bones of the forearm the dislocation is first reduced and then internal fixation of the ulnar fragments is established

Following closure of the wound, the elbow is immobilized at a right angle A posterior plaster shell may be applied and worn for a few days, but it is sufficient to use a tight bandage and carry the arm in a sling Exercises of the fingers and shoulder are started on the second day, the patient squeezing a rubber ball and abducting the arm hourly Gentle motion of the elbow, in flexion and extension, can usually be started on the fourth or fifth day after reduction At this time hot fomentations may be of help The screw or nail may be removed in about six months, but this is optional

Forearm —For the *mangled forearm* with bones shattered and which is extensively lacerated, David Brown[8] (Sunderland) uses a method by which there is no danger of circulatory failure due to a tight plaster cast and the wounds can be inspected without disturbing immobilization

Technic —After the wound toilet is complete, a fine Kirschner wire is inserted obliquely across the back of the radial border of the second metacarpal, about 1 in proximal to the head of the bone A second wire is put through the subcutaneous border of the ulna 3 in distal to the tip of the olecranon A large stirrup is attached to each wire An assistant now holds the arm suspended by the distal stirrup the elbow is left at a right angle The proximal stirrup is allowed to hang down behind the olecranon The weight of the arm so suspended is enough to produce full length, though alinement and rotations will need to be adjusted

While the arm is still held suspended the stirrups are

(8) Brit. M J 2 495 6 Oct 10 194

TECHNIC —The operation is best carried out three to five days after injury, when the swelling will have subsided A general anesthetic is administered and a tourniquet applied.

A longitudinal incision is made, beginning 1 in above the tip of the olecranon and extending down to a point 1 1½ in below the fracture cavity The incision is carried down to the periosteum, and the skin and subcutaneous tissues are retracted laterally to expose the fracture cavity Blood clots, tabs of torn periosteum and detached spicules of bone are removed The ends of the fragments are cleaned with pledgets



Fig 239 (left) —Comminuted fracture of olecranon with displacement
Fig 240 (right) —Same case five months after reduction with longitudinal nail in place

of gauze The forearm is extended and the replacement of the fragments studied

The forearm is then flexed about 15 degrees, and a short longitudinal incision is made in the triceps tendon above the tip of the olecranon A small drill is inserted in the proximal fragment, at the tip of the olecranon and forced through the fragment into the center of the fracture cavity The fragments are approximated and held in position by a tenaculum

A screw of sufficient length to fix the fragment to the ulnar shaft is passed through the drill hole and threaded into the

ulna. If possible, it is well to so direct the screw that it engages the distal cortex of the ulna, thus providing for perfect fixation (Figs 237 and 238) If a nail is used, it must be sufficiently long so that its tip engages the cortical bone beyond the bow of the ulna (Figs 239 and 240) The lateral expansions of the triceps tendon are sutured with interrupted chromic catgut

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(8) Brit M J 2 495 496 Oct 10 1942



F 41 —I osterior iew N te that the K rschner wire which transfix s the metacarpal does not i t ifere w tl m ement of the thumb or p erce a y of the extensor tendons

connected by two plaster ropes, each made of three 6 in cellona bandages Further adjustment may be made while the ropes are drying These ropes are parallel to the forearm, about 2 in from it and when dry convert the whole structure into a rigid skeleton splint with fixed skeletal traction Dressing is completed with a layer of wool and a bandage which encircles the side bars of the splint Addition of extra wool anteriorly or posteriorly combined with firm bandaging, will correct any tendency to backward or forward bow Finally, a removable anterior plaster cock up splint may be bandaged on to immobilize the fingers

When the patient returns to the ward the forearm is suspended vertically with the elbow at a right angle, and accurately counterbalanced by a weight (Fig 241) This is the best position to allow swelling to subside and puts least strain on the splint Inspection of the wound or further surgical treatment can be carried out by removing the bandage which holds the dressing, and the arm need not be removed from its suspended position during the process

Directly all active sepsis has disappeared, the wires may be removed and a plaster applied, usually in two or three weeks This needs emphasis since in absence of definite indications, the disadvantages of skeletal traction, such as wire track sepsis and delayed union, will outweigh advantages of this form of immobilization

Wrist—*Arthrodesis of the Wrist with Grafts of Cancellous Bone*—Leroy C Abbott John B DeC M Saunders and Frederic C Bost[7] (Univ of California) describe a procedure in which arthrodesis of the wrist is done but the mechanism of the radio ulnar and carpo metacarpal joints is preserved therefore maintaining as far as possible the unity of action of the extremity as a whole The operation was performed 50 times in 48 cases which included spastic paralysis Volkmann's ischemic paralysis residual paralysis of acute anterior poliomyelitis traumatic arthritis obstetric paralysis injuries to peripheral nerves tuberculosis of the wrist and bilateral deformity of the forearm The procedure is applicable to adults and children, but it is inadvisable to operate

(7) J Bone & Joint Surg 24 883 898 October 1942



Fig 941 —Post r or iew N te that the Ki schn r wire which transfixes the metacarpal doe not t fere w th n emc t of the thumb or p e ce any of the extensor tendons

tions which separate the tendon sheaths over the lower parts of the radius and ulna This ligament and the periosteum are incised vertically over Lister's tubercle The posterior aspect of the lower end of the radius is exposed subperiosteally, care

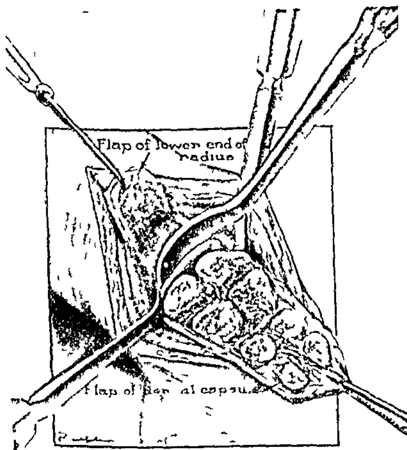


Fig 4? —Flaps are raised and radiocarpal and intercarpal joints exposed cartilage is remo ed fr m ra li carpal j i t with a curve l go ige

being taken to preserve as far as possible the tendon sheaths of the extensor pollicis longus extensores carpi radialis longus and brevis and extensor digitorum communis These sheaths are retracted to the radial and ulnar sides to expose the dorsal aspect of the radiocarpal and intercarpal joints The posterior

on children under 12 because of insufficient bone development There was only one failure, in an adult in whom fusion did not occur

Cancellous bone is more rapidly revascularized and revitalized by living bone than cortical bone It is plastic and especially adaptable in arthrodesis of the wrist In addition, the risk of complications is greater when grafts are taken from the tibia, fractures of this bone at the site of removal of the graft are not infrequent and may occur even after six months

TECHNIC —*To expedite the procedure, it is best to remove* the bone from the ilium as the first step and then to proceed with fusion of the wrist In this way the transfer of instruments *from one wound to the other is avoided* At times an assistant may remove the graft while the surgeon exposes the wrist joint

The *anterior part of the ilium is exposed* by an incision through the skin and subcutaneous tissue along the lateral margin of its crest At the junction of the external oblique muscle above and the tensor fascia femoris and gluteus medius below, the periosteum is incised and elevated medially and laterally, care being taken to stay as close to the bone as possible to avoid bleeding In children, the technic is modified so as to disturb as little as possible the epiphyseal cartilage which *rims the crest The incision through the periosteum* is made along the lateral border of the crest, the glutei are reflected laterally, and the cartilaginous portion of the crest is incised along its junction with the bone, and is raised upward and medially By this method the cartilage is not separated from the musculature of the trunk, and most of the blood supply is preserved When the cartilage is completely elevated, the upper part of the medial surface of the ala or iliac fossa is exposed The grafts are removed with an osteotome held parallel to the crest Then the periosteal attachments of the muscles of the trunk and thigh are firmly sutured together over the iliac crest with interrupted figure-of eight sutures of no 1 braided silk

On the wrist, a blood pressure cuff is used as tourniquet A straight or preferably curvilinear, incision is made over the posterior aspect of the wrist with its center over the dorsal tubercle of Lister Retraction of the skin and subcutaneous tissue expo es the dorsal carpal ligament and the fibrous par

wrist band (*1*) stiffened so as not to buckle and padded so as not to impede circulation The finger piece consists of a metacarpal strap (2) to which four finger cots (3) with adjustable elastic tapes (4) are tied The metacarpal strap is suspended

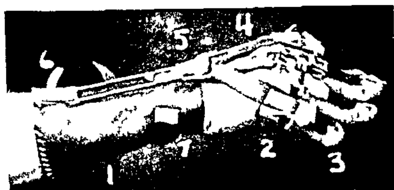


Fig 243

in turn by elastic traction to the pivot piece (5) This piece is tied to an attachment (*6*) on the wrist band Increasing tension between pivot piece and wrist band can balance the antagonistic action of the flexor muscles A separate slip (7) for the attachment of the thumb cot on either side allows use of the splint on either hand

The familiar metal cock up splint usually has a volar wrist piece with a terminal support which fits into the palm It can be attached, if necessary, to this type of splint for added support The elastic variety, however, permits greater use of the hand

Hand —There is a *middle palmar septum* extending from the under surface of flexor tendons of the midfinger to the middle metacarpal bone which divides the palmar concavity into thenar and midpalmar spaces This septum is a constant finding and J Edward Flynn[8] (Boston) demonstrated it in each of 100 dissections Clinical evidence shows that the middle palmar septum is a definite barrier in preventing spread of infection from one deep fascial space to another In only 2 of 100 cases

(8) Surgery 14 134 141 Jul 1943

ligament of the radiocarpal joint is incised horizontally along the lower margin of the radius The wrist is then held in palmar flexion while the cartilage is removed with a special gouge from the lower end of the radius and the upper surfaces of the navicular and lunate bones The intercarpal and the transverse intercarpal joints are exposed en masse by turning distally, with the aid of an osteotome, a curved flap, consisting of the fibrous capsule of these joints together with a thin section of cortex from the posterior surfaces of the navicular, lunate and capitate bones In adults, a thin flap of bone from the dorsal aspect of the radius is then cut and turned up with an osteotome (Fig 242) In children, after similar exposure of the joints, a horizontal cut is made on the articular surface of the lower end of the radius into which the grafts are eventually fitted, thus avoiding injury to the epiphyseal line With a curet and sharp knife, the cartilage is removed from the inferior surfaces of the navicular, lunate, capitate and if readily accessible, the surface of the lesser multangular The spaces between the denuded surfaces of the carpal bones and the lower end of the radius are packed with chips of cancellous bone and broad, pliable sections of the bone are placed over the entire posterior aspect of the radiocarpal, intercarpal and transverse intercarpal joints Fixation of these grafts is secured by first tucking their upper and lower borders beneath the bases of the bone flaps raised from the carpus and radius, and later securing them by dorsal flexion of the wrist

The wound is closed by silk sutures which approximate the margins of the bone flaps, the periosteum on the lower end of the radius and the ligaments A plaster of paris cast is applied from the upper arm to the tips of the fingers and the thumb, with the elbow at right angle and the forearm in mid pronation The wrist is fixed in 10 to 15 degrees of dorsal flexion, while the joints of thumb and fingers are moderately flexed The cast is carefully molded about wrist and palmar surfaces of the hand and fingers, and is cut over the back of wrist and forearm to allow for swelling After three weeks, a second short plaster cast, extending from just below the elbow to the metacarpophalangeal joints is applied The position of the wrist is checked carefully at this time

Harold Elliot[9] (R C A M C) describes an *easily made drop wrist splint*

APPARATUS —This consists of a separate and adjustable

(9) Canad M A J 47 363 October 1942

finger occurred in 6 per cent, with spread of infection to the ulnar bursa in half the cases, or 3 per cent of the entire series, and to the radial bursa from the ulnar bursa in 2 per cent of the entire series The pronator quadratus space in the wrist was involved in three patients and the interflexor space in the forearm in 3 per cent of the entire series Average stay in hospital was 19 9 days

Results were generally poor 47 per cent were in group 1, bad, 20 per cent in group 2, fair, and 33 per cent in group 3, best Results are no better than those reported 30 years ago and by others

The greatest hope for improvement in results lies in the early treatment of suppurative tenosynovitis and proper observation of wounds of the fingers Extreme care not to change bacterial flora from a single strain to a mixed infection is of great importance Incisions should be adequate to drain every pus pocket Rubber tissue drains may be used but are usually discarded in 24 to 48 hours Sulfonamides, with sulfadiazine in particular, when used early, parenterally and locally, are of real value in decreasing incidence of severe complications

After operation, the hand should be elevated on a pillow to aid drainage Active motions should be avoided until infection subsides The hand should be placed in an aluminum splint in a position of function Dressings and soaks are performed with strict asepsis With tendon slough but in absence of osteomyelitis or septic arthritis, manipulation of the fingers is performed to prevent adhesions and permit future tendon grafting The patient should be hospitalized until infection subsides

Fractures of Metacarpals Exclusive of the Thumb — Richey L Waugh and G P Ferrazzano[2] (U S Marine Hosp Boston) describe a new method of treatment which they have used in 22 cases of shaft and so called "knuckle" fractures Results were excellent in 14, satis

( ) Am J Surg 59 186 194 February 1943

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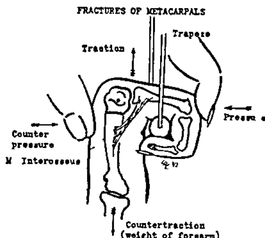
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(2) Am J Surg 59 186 194 February 1943

factory in 7 and poor in 1 The basis of treatment is early correction of the primary anatomic deformity of the fracture and rigid fixation of the fragments, with



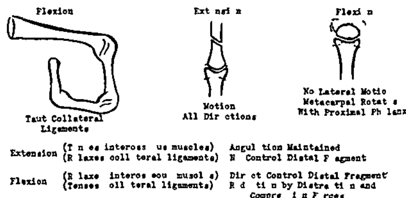


Fig 244 (top)
Fig 245 (bottom)

the hand in position of grasp (optimal function) but with all metacarpophalangeal and interphalangeal joints free during the period of immobilization

TECHNIC —To reduce the fracture the forearm is suspended vertically with the hand grasping a small trapeze (Fig 244)

The phalanges flexed over the small cylinder of the trapeze produce the traction, and weight of forearm and arm the countertraction forces. The flexed proximal phalanx relaxes the interosseous muscles and tightens collateral ligaments (Fig 245) and synovia (capsule) of the metacarpophalangeal joint, allowing positive control of the distal fragment of the fractured metacarpal The actual reduction is effected by compression by the surgeon left index finger and thumb (Fig 244) Pressure is applied over the

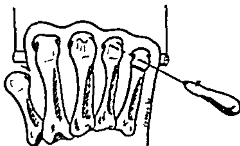
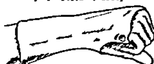


Fig 246

flexed proximal interphalangeal joint, and counterpressure over the dorsum (the site of the dorsally bowed metacarpal fragments)

Rigid fixation is secured by a Kirschner or Mathews wire about 2½ in long inserted transversely as a "pinion" through the distal ends (heads) of the fractured and adjacent one or two metacarpals (Fig 246) Novocain solution is used at the







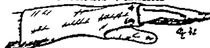


Fig 247

site of insertion of the wire and between the heads of the fractured and adjacent metacarpals

A light plaster of paris or starch bandage, incorporating a small cork capped over the ½ in wire protruding through the skin at site of insertion is applied to the hand and distal half of the forearm The fingers are not encased in the cast

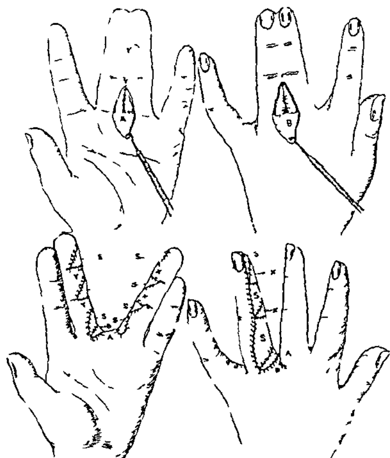


Fig [illegible]48 (top left) —Base of flap *A* is equal to about one half the width of two fingers and is in line with webs of other fingers in length is one half to one-third the distance to crease of first interphalangeal joint A little fat is left on under surface to insure good blood supply Zigzag incision extends one third to one half way across each finger transverse portions being through creases of interphalangeal joints On e finger are two flaps Y X which prevent straight line of union between graft and skin of finger flaps *Y* Y on other finger serve same purpose

Fig [illegible]49 (top right) —Base of flap *B* is at level of knuckles and extends one-half to two-thirds the distance to first interphalangeal joint On this surface fingers are separated by straight incision continued deeply until fingers are separated with care to avoid injury to X and *Y* flaps.

Fig [illegible]50 (bottom) —Operation completed *A* palmar flap *B* dorsal flap Y flaps on ring finger *Y* flaps on middle finger *S* skin grafts

be taken from the thigh using the Blair suction box or the Padgett dermatome A pattern may be obtained by pressing a piece of fine mesh gauze against the side of the finger and cutting out the portion which is blood stained The skin graft is cut to this shape It is sometimes easier not to cut notches for the V and Y flaps until after the graft has been partially sutured in place If a full thickness graft is used, even pressure on the graft and perfect immobilization are essential as these grafts are less likely to take than the split graft Figure 250 shows disposition of flaps and grafts

The fingers are dressed with several layers of gauze between them, bandaged together snugly and immobilized with a light wood splint extending from finger tips to the elbow The dressings are kept wet with boric acid solution the first three days Unless there is evidence of infection dressings are not changed for 7 to 10 days Splinting is usually continued for another week It is wise to observe the fingers twice a week for at least a month for any sign of beginning contracture, if noted, an extension splint is applied immediately The desirable time for operation is during the third year of life

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LOWER EXTREMITY

Hip —W Eugene Wolcott[2] (Green Bay, Wis) used the injection method to study the *evolution of the circulation in the developing femoral head and neck* The ossifying center in the head of the femur in infants and children receives its blood supply from the visceral capsule vessels which arise from the median circumflex artery The ligamentum teres vessels do not enter the head of the femur in children, nor do they contribute to the nourishment of the growing femoral head, except for small vessels which accompany the fibrous tissue at the implantation of the ligamentum teres into the fovea

(2) Surg Gynec & Obst. 77 61 68 July 1943

area The anastomosis between the ligamentum teres vessels, the capsular arteries and the nutrient artery of the shaft does not take place until the ossification of the head of the femur is practically, if not entirely, complete, at which time the vessels of the three systems unite by penetrating the thinned out cartilage area at the fovea, thus establishing the anastomosis The ligamentum teres circulation is a closed circulation in so far as the femoral head is concerned until such an anastomosis takes place

Aseptic necrosis of the head of the femur occurs less often if the transcervical fracture is immediately and accurately reduced and adequately immobilized

In experiments on dogs carried out by Edward L Compere (Chicago) and George Wallace[9] (Rochester, Minn) necrosis with collapse of the weight bearing portion of the cortex of the head occurred in two of six animals following accurate reduction of the fracture and pinning of the fragments, although the fracture united In these two dogs the head of the femur may have been viable when union occurred, but, with partially depleted blood supply the minimal traumas of continued use and weight bearing may have resulted in necrosis and disintegration

The prognosis for survival of the head of the femur is definitely less satisfactory if reduction of the fracture is not anatomically correct or if pinning of the fragments is not adequate for complete immobilization

Death of the head of the femur when the fracture was neither reduced nor immobilized was found to occur in 9 of 12 hips studied It is possible that weight bearing activity and friction between the fragments may have ruptured blood vessels that were left intact after fracture in a portion of the posterior capsule However, this theory does not explain the difference in incidence

(9) J Bone & Joint Surg 4 831 841 October 1942

of necrosis in cases in which the head was pinned without accurate reduction and in those in which the head was pinned in an anatomically correct position

Paul H Harmon[1] (Sayre, Pa) reports the late results (about 18 months) of *foreign body cup arthroplasty of the hip in osteo-arthritis,* a plastic methacrylate cup (lucite, plexiglas, etc) being used Of 16 hips (13 cases),

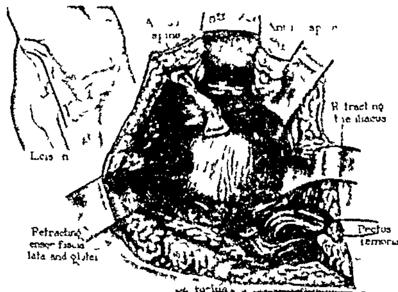


Fig 1—Incision and precapsular dissection in exposure of movable osteo arthritic hip

the results were excellent in 10, good in 3 and poor in 3 Viewed in retrospect, two of the three cases with poor results were errors in selection

Plastic cups are totally transparent to roentgen rays, so that osseous changes in the hips can be visualized The material appears to be well tolerated, its further use seems to be warranted in this and other conditions in which hip joint arthroplasty is indicated More time and experience will be required to determine if less pain

(1) Surg Gynec & Obst 6 347 36 March 1943

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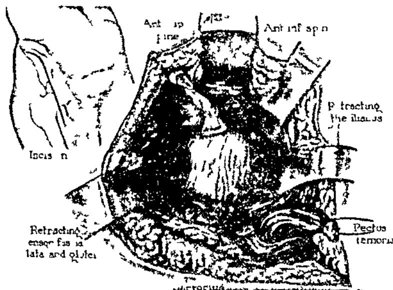


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(1) Surg Gynec & Obst 76 347 365 March 1943

is experienced with a plastic cup arthroplasty than with a metallic cup arthroplasty Present experience points to the affirmative

A simplified operative technic is described which is applicable in the presence of a movable hip (Fig 251-253) According to this modification it is necessary to reshape only the femoral head when a suitable fit is already present between the exterior of the cup and the acetabulum, and the amount of muscle detachment from

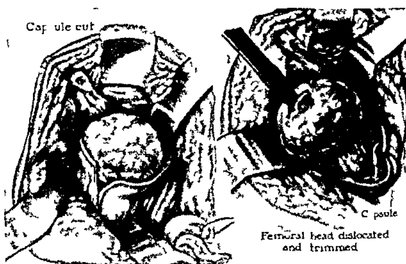


Fig 25 —Dislocation and trimming of enlarged and irregular osteo arthritic femoral head

the ilium is reduced to a minimum It is recommended that the hip joint capsule be closed with interrupted stitches of suitable material

Smaller cups of the same material are applicable in arthroplasty of the temporomandibular and metacarpo phalangeal joints

Armin Klein, Robert J Joplin and John A Reidy[3] surveyed the records of 32 patients with *slipping of the capital femoral epiphysis* in 39 hips These patients had

( ) Arch Surg 4 681 686 May 194

been given treatment for this condition at Massachusetts General Hospital during the last ten years

In three cases of marked slipping in which osteotomy was done at a point distal to the site of the deformity, i e, distal to the epiphyseal plate, results were uniformly poor Therefore this method should be discarded

The present treatment, arthrotomy of the hip joint, reposition of the displaced epiphysis on the neck and

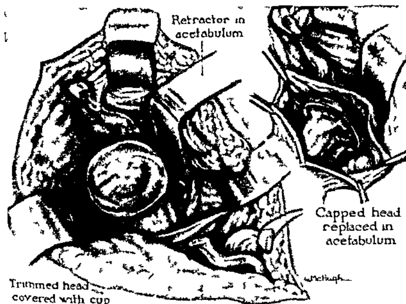


Fig 53 —Capping the trimmed head and replacement into acetabulum (Harmon p 655)

fixation by a three flanged nail, followed postoperatively by traction and the wearing of nonweight bearing splints should be continued for patients with marked slipping of the epiphysis The group thus treated showed hip function 76 8 per cent of normal

Lateral nailing in situ, without arthrotomy and without correction of the early deformity, is the best method of treatment for patients with minimal slipping of the epiphysis and this despite good results obtained from

drilling and traction The authors have seen two hips with minimal slips left untreated, except for use of non weight bearing splints, continue to slip to a marked de gree Since drilling and traction do not immobilize the epiphysis any more than a nonweight bearing splint, they advocate lateral nailing in situ This demands no more skill of the surgeon and entails no more risk on the part of the patient than does the drilling operation It has afforded the most gratifying results, averaging 94 8 per cent of normal hip function Drilling and traction average only 87 6 per cent

The authors stress the importance of diagnosing the condition early, while the slip is still minimal, of obtain ing early fixation with lateral nailing in situ, of mobiliz ing the hip early after operation and of recognizing early a possible slip in the contralateral hip

W K West[2] (Oklahoma City) finds that *treatment of slipped upper femoral epiphyses* is far from satisfac tory The methods used by various orthopedic surgeons are usually better suited to early than to advanced cases In early cases the condition is best treated by simple fixation and protection either by plaster or by the Thomas caliper walking splint In those in which there is a freely movable head, it is safe to give an an esthetic, and manipulation can be done without danger of damaging the head

When union has taken place, but the deformity is not too great, simple osteotomy with a large wood carver's chisel through the epiphyseal line, followed by proper protection, is the method of choice

Skeletal traction prior to open reduction certainly has its place Smith Petersen nails may be used by ex perienced orthopedic surgeons, but never by the inex perienced There is in addition danger of damage to the necrotic head, even though the operation has been

(2) South M J 35 1082 1085 December 1942

done expertly Arthroplasties in these cases should be done rarely because of the shortening of the leg, instability and possibility of a permanently painful hip

Wilbur B McKibbin[3] (Seattle) describes an *ambulatory method of treatment for intertrochanteric fractures of the femur* in which fixation of the fragments is secured through the closed insertion of four pins

TECHNIC—Two pins pass within the neck into the head of the femur and are firmly united with two passing at a converging angle through the upper end of the distal fragment

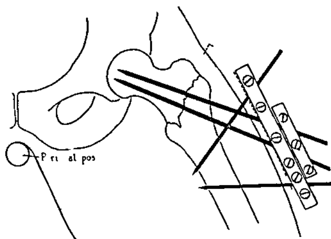


Fig 954—Anteroposterior view of fixation in place Dotted line represents initial plaster first applied Long clamp is on the t o distal pins and the short one on the two prox mal ones This unit is later incorporated in a plaster cast to the thigh

This unit creates a solid bridge across the fractured area and gives complete fixation in any type of intertrochanteric fracture The patient is not confined and may move about in bed immediately after operation and be up in a chair, the more active patient being about on crutches in a few days

After the pins are introduced sterile dry dressings are placed over them and a layer of sheet wadding is applied about the thigh followed by a number of turns of plaster which embrace the pins and firmly and smoothly press the soft tissues along the pins toward the shaft To unite the pins

(3) Surg Gynec & Ob t 6 343 346 March 1943

more firmly than is possible with plaster alone two flat pieces of metal bar, which have been drilled so that they may be tightened together by screws or bolts, are used as a clamp over the pins A clamp is placed about each set of pins, made snug against the plaster and tightened (Fig 254) The clamps and pins are united by plaster and incorporated in a light cast to the thigh, its extent being such that free motion of the hip and knee is possible (Fig 256) The pins are left in until solid union at the site of fracture has been accomplished

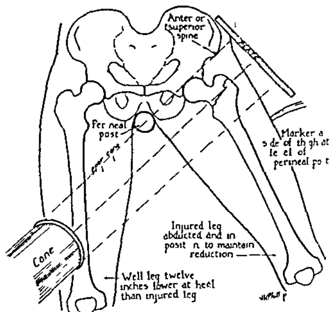


Fig —View from abo e w h n lateral x ray films are taken Marker shown is used as guide fo insert on of first p n vhe anteroposterior view i taken. (McK bbin abo e)

Bernard B Larsen[4] (Western Reserve Univ) has *inserted the Smith Petersen nail without initial skin incision* in over 60 cases with satisfactory results The small amount of anesthesia required (40 50 mg novocain intraspinally) the shortness of the procedure and absence of blood loss decrease the possibility of shock in these patients who are usually old The danger of infection is minimal

(4) Surg Gynec & Obst 77 187 192 August 1943

TECHNIC—Reduction of the fractured hip by the Leadbetter maneuver is verified by an anteroposterior and a lateral roentgenogram, and the leg is held by an assistant in marked internal rotation and moderate abduction. The site of operation is prepared with an antiseptic, and a cloth wet with bichloride solution is placed over the field and left in place during the entire procedure. The usual draping is done after this cloth is in place.

A simple instrument, consisting of a Steinmann pin, a small caliber trochar and a block of steel with three parallel holes drilled through it, one the diameter of the trochar and two the diameter of the Steinmann pin, is used. The centers of the latter two holes are [illegible]/8 in. and 1[illegible]/16 in. from the center of the hole having the diameter of the trochar. In extra large bones, the holes farthest apart and in all other cases the holes closest together are used. A towel clip is placed deeply into the anterolateral aspect of the thigh, and the belly of the vastus lateralis muscle is pulled forward. This makes the shaft of the femur just distal to the trochanter, which is the optimal location for the nail, more easily palpable and also presents an almost avascular area through which to operate. The Steinmann pin used as a probe is thrust through the skin and along the middle of the anterior portion of the neck of the femur. A chuck handle is used to make handling of the pin easier. The point of the pin is pushed hard against the head of the femur when its resistance is met. Fluoroscopic visualization makes it extremely simple. If the operation is done blindly, an anteroposterior roentgenogram is taken at this point to be sure that the pin is properly placed. This pin is grooved each ½ in. so that the length of Smith-Petersen nail which will later be re-



Fig. [illegible].—View of fixation. Patient had been on crutch [illegible] one week. (McKibbin, p. 6 9.)

quired can be computed easily on examination of the roentgenogram The steel guide block is now threaded on the pin up to the skin and so placed that the hole for the trochar lies directly posterior The trochar is placed through this hole and thrust through the skin and hard against the shaft of the femur The obturator of the trochar is hit sharply so as to dent the femoral shaft, and is then removed

A guide wire for the Smith Petersen nail, which is 10½ in long and 3/32 in in diameter, is threaded through the trochar and drilled into place if the fluoroscope is used If not, the wire is drilled in 2 in and then pounded into its proper position The guide instrument is removed leaving the guide wire in place

If the fluoroscope was used, the length of the Smith Petersen nail needed is determined by placing another 10½ in wire alongside the inserted guide wire with the tip against the shaft of the femur The difference in the apparent length of the two wires is the proper length of nail to be used A small skin incision is made along the guide wire, just large enough to admit the Smith Petersen nail, which is threaded over the guide wire and driven home There is no bleeding The guide wire is removed and the incision closed with a single skin clip

For years, the staff[4] of Davis Hospital, Statesville, N C, has treated *intertrochanteric fractures in the aged* with a combination of a Smith Petersen nail inserted into the neck of the femur and an angle bar to maintain the proper relationship between the neck and the shaft of the femur and prevent shortening of the leg In patients of almost any age whose general physical condition is fairly good union is often obtained and the patient can walk again almost as well as before injury The great advantage of this treatment is that the patient can move about in bed sit up move the foot and knee and be placed in a wheel chair soon after operation if necessary This has a profound influence on the patient's chances of recovery Another factor is the economic aspect The patient remains in the hospital only a short time

(4) South Med & Surg 104 665 666 December 1942

The tissues of these patients bear metal much better and healing is usually far more prompt and satisfactory than would be expected by one who has not tried the method. In the very aged, pentothal is the best anesthetic, as it apparently does not disturb them in the least. Any drug that lowers or raises the blood pressure or affects the patient adversely should be avoided.

Snapping Hip.—Howard Dudgeon, Jr.,[5] reports six cases, all in young males. The incidence was 1 in 650 admissions to the orthopedic service of the Station Hospital, Camp Bowie, Tex.

There is some question as to the etiology of this condition. Dudgeon considers it due to trauma to the iliotibial tract or the tensor fasciae femoris, and possibly the insertion of the gluteus medius muscle. However, most cases follow injury to the iliotibial tract alone. After a vertical tear in the tract in the region of the greater trochanter, the healed scar forms a hard ridge which whips back and forth over the greater trochanter with each step. The patient complains of snapping, which he can feel and occasionally hear. There may or may not be pain. If present, it is always in the region of the greater trochanter and may be referred down the anterolateral aspect of the thigh to the knee. There is a palpable cord whipping over the greater trochanter and occasionally seen to jump under the skin during locomotion. The correction is surgical if pain and disability are present.

Operation should be done under local anesthesia, as the tense band is found with difficulty if the muscles are fully relaxed by inhalation anesthesia. The technic used is that described by Campbell.

TECHNIC.—An incision is made in line with the junction of the gluteus medius and tensor fasciae femoris muscles to the posterior border of the greater trochanter; it is then continued distally in the longitudinal axis of the thigh for 4 in.

(5) Am. J. Surg. 59: 496-500, March 1943.

When the iliotibial band is incised a definite, thickened strip may be palpated on its posterior inner surface This portion is dissected up to the trochanter, forming a flap 3 to 4 in long The distal end of the tensor fascia femoris is then freed The distal half of the fascial flap is cut off, and the remaining fascial flap is transferred anterior to the greater trochanter, sutured to the fascia on the anterolateral aspect of the thigh and fixed by chromic sutures

The leg is not immobilized in a cast as was formerly the practice, but a snug, tight dressing is applied to prevent any postoperative oozing It is a good idea to use a soft rubber drain for a few days as there is a large area of skin that has been undermined Exercise should be started as soon as the wound has healed

Two patients were operated on successfully, one awaits operation, another was advised to have surgery but refused it and no operation was indicated in two

Thigh—Pulmonary complications are more frequent in thigh amputations than in any other field of surgery J Ross Veal[5] (Gallinger Munic Hosp) made a close study of a number of these cases and found that many of the pulmonary lesions are embolic in origin and that the chief source of the emboli is the femoral vein in the amputated stump He proposes to *prevent pulmonary complications following thigh amputations* by performing high ligation of the femoral vein before amputation to close this source of emboli In support of his concept he states that in 275 major amputations without high ligation of the femoral vein 14 9 per cent of the patients died of pulmonary complications while in 80 thigh amputations with high ligation of the femoral vein there has been only one pulmonary complication

TECHNIC—The femoral vein is best exposed in the femoral triangle through a vertical incision directly over the vessels (Fig 257) The incision should be 3 in long and begins 1½ in below the inguinal ligament The saphenous vein is identified and followed down to its entrance into the femoral At this point the femoral sheath is opened The vein is joined by several tributaries at this level and these must be carefully

(5) J A M A 1 1 40 44 Jan 1943

protected The femoral artery is retracted laterally and the vein gently exposed just below the entrance of the saphenous The vein is freed sufficiently at this point to allow the passage of a ligature The most logical site for ligation is just distal to the entrance of the saphenous vein This point is easily located by following the saphenous through the cribriform

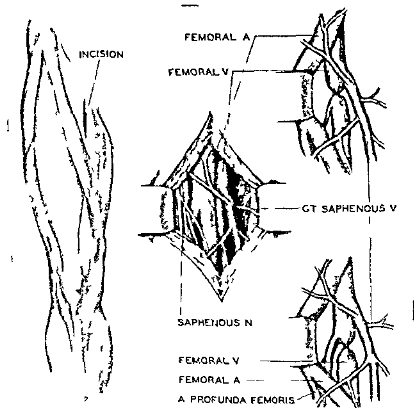


Fig 57 —Technic of ligation of femoral vein in femoral triangle

fascia, and ligation at this level insures adequate inflow of blood above the ligature to prevent the formation of a thrombus There are also abundant channels available for the return blood flow If the deep protunda joins the femoral very near the sapheno femoral junction it is best to ligate the femoral distal to the profunda The femoral vein is large and its wall relatively thin and care must be exercised in freeing it from its bed Passage of the ligature can be facilitated by clamping

the vein at the selected site with a hemostat The vein can then be lifted out of its bed sufficiently to allow the ligature carrier to pass completely around it with ease and safety Because of the wide variation in the size of the vein and the limitation of exposure, various size ligature carriers are needed A silk ligature is passed around the vein and securely tied The incision is closed in the usual manner

Following amputation, a loose dressing is applied and the patient placed under a heat cradle The stump is not elevated In practically all cases there has been prompt readjustment of the venous return blood flow In a few cases the stump has become swollen with pitting edema apparently due to the occurrence of thrombosis in the profunda vein The edema always subsided in 10 days and produced no further trouble

Muscle Transplantation for Combined Flexion Internal Rotation Deformity of the Thigh in Spastic Paralysis—For 10 years, Joseph S Barr[6] (M C, U S N R) has used this operation which re enforces the power of abduction, external rotation and extension and diminishes the power of flexion and internal rotation Therefore on theoretical grounds it would appear to be superior to simple tenotomy of the overactive muscles

If the patient's chief motor disability is athetosis or if he has a progressive degenerative lesion of the central nervous system the operation is contraindicated Suitable cases are those in which there is true spastic cerebral birth palsy or a static acquired lesion of similar character The chief elements in the deformity should be flexion and internal rotation of the hip Severe adduction deformity should be corrected by tenotomy and obturator neurectomy This may be done at the time of the transplantation or preliminary to it The operation should be reserved for patients with reasonably good mentality who have the ability to walk

TECHNIC—With the patient under general or spinal anes

(6) Arch Surg 46 605 607 May 1943

thesia and lying on the side opposite that of operation or in a hip trough, a field extending from the lower ribs to the knee, including the whole thigh, and from the midline of the abdomen anteriorly to the midline of the back is prepared The leg is draped separately, so that it can be manipulated during operation Severe adductor spasm must be overcome by adductor tenotomy and/or obturator neurectomy before proceeding with the operation The incision begins at the posterior superior spine of the ilium, curves forward along the iliac crest to the anterior superior spine and extends down and slightly out on the anterior part of the thigh for 6 to 8 in After the incision is carried down to the deep fascia, the cutaneous flap is reflected from the underlying tensor fasciae latae muscle The anterior edge of the tensor fasciae latae muscle is freed distally to the point at which the ascending branch of the anterior femoral circumflex artery comes into view Beginning inferiorly at the anterior edge of the muscle, the operator frees its under surface, carrying the dissection from below upward Freeing the posterior margin of the muscle is unnecessary, and, if attempted, there is danger of damaging its nerve and blood supply As the dissection is carried above the great trochanter, the anterior border of the gluteus minimus muscle is defined A muscle mass consisting of the whole tensor fasciae latae and the anterior third of the gluteus minimus and gluteus medius is freed from its iliac origin (Fig 258) Two or three traction sutures are secured to the free end of the muscle mass

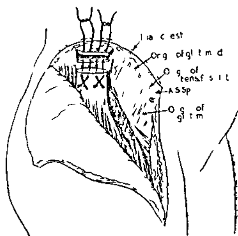


Fig 258 —Approximate amount of muscle transposed and method of securing free end of the muscle to ilium.

As an assistant holds the leg with the knee extended and the thigh in 20 degree abduction and full extension but neutral as regards rotation, the operator transposes the muscle mass so that it lies in greater part posterior to the coronal plane of the trochanter and pulls its free end as near the iliac crest as

its length permits This point is the site selected for the new origin of the muscle Usually the muscle is too short to reach *the iliac crest, but occasionally it can be attached there* The bed for insertion of the muscle is prepared as shown in the sketch (Fig 2)8) A slot ¼ in wide and 1½ 2 in long is cut in the outer table of the ilium The superior margin of the slot is levered gently outward after the making of divergent cuts ½ in long at the two ends of the slot The free ends of the silk traction sutures are passed by a curved needle into the slot to emerge from drill holes in the outer table of the ilium The free end of the muscle mass is then carefully drawn into the slot and the sutures are tied as the leg is held in the corrected position The wound is closed in layers and the leg is immobilized in plaster in the abducted, fully extended and slightly externally rotated position

Assisted motion and gentle physical therapy may be instituted as soon as the wound is well healed Full weight bearing is permitted four to six weeks after operation The extended, abducted and externally rotated thigh may be maintained in this position at night for as long as the surgeon deems advisable, but prolonged use of retentive apparatus is usually unnecessary *All* patients operated on by this method have obtained a satisfactory result so far as correction of the flexion internal rotation deformity is concerned

Knee—J E Milgram[7] (New York City) describes four cases of *tangential osteochondral fracture of the patella* proved at operation and mentions three in which the diagnosis was strongly suggested but not verified surgically

In the first three patients who were operated on soon after the initial accident definite injury to the lateral femoral condyle and patellar fracture was visible In the first the changes were severe and those of a stellate impacted fracture of the condyle In the other two layers of cartilage had been sheared off and hung still attached in the midst of adherent blood clots This

(7) J Bone & Joint Sur 71 80 April 1943

suggests tangential direction and nature of the stresses

The patella momentarily rubs tightly sideways over the outer condyle with sufficient force to score the cartilage of the patella and femur and leave "glacial grooves" on the patella Occasionally, probably more often than can be demonstrated, true dislocation occurs Then the medial border of the patella catches against the prominent edge of the femoral condyle As the quadriceps pulls the patella back into line, a chondro osteal layer is ripped off and left behind and the condylar synovial membrane locally is markedly traumatized

In each of these cases, the forces involved were purely muscular and indirect The lesion can also be caused by direct (glancing, tangential) blows

In patients operated on immediately or soon after the injury, the knee joint is distended with blood The free body is large and characterized by sharp palisade like edges, where the cartilage has been broken free from its normal continuity The cartilage is firm, glistening and obviously normal but marked by fresh scratches or grooves The layer of bone which adheres on separation and is revealed by careful study of the roentgenogram is usually but not necessarily thin The marrow, early, is normal The defect is grossly fresh and filled with a blood clot

In patients operated on even three weeks after the injury, the defect is already healing, while the loose body is beginning to undergo degeneration which will eventually make it indistinguishable from the free body of idiopathic degenerative osteochondritis dissecans

In patients operated on a year after injury, the free body consists essentially of cartilage which was once necrotic and is now calcified slowly growing smooth by accretion

In presence of hemarthrosis particularly in the young, the patella should be carefully scrutinized for evidence

of articular irregularity A flake-like shadow in the joint may make possible a reasonably certain diagnosis

Operation is indicated to remove the free body Inspection of the articular patellar surface and particularly of the external condyle of the femur is facilitated by a lateral incision somewhat shorter than the median patellar type While the inferior medial quadrant is the commonest site of separation, the entire patellar cartilage must be visualized

Donald B Slocum and Donald E Moore[8] (M C, U S A) discuss *posterior horn lesions in meniscal injury* These lesions frequently exist both alone and in association with tears of the rest of the cartilage The presence of a "posterior click" immediately behind the collateral ligament is evidence of posterior horn pathology, but absence of the sign does not eliminate this pathologic condition

To elicit the posterior click, the patient is placed on his back with the knee in full flexion, and the examiner stands by his side One hand locates the joint line and the other firmly grasps the foot The tibia is first internally and externally rotated, and then abducted and adducted Following this it is forced into external rotation and extended and then placed in internal rotation and extended During this maneuver a click is felt and frequently heard in the joint line posterior to the collateral ligament This must be differentiated from the crepitant, grating sensation of a synovitis The patient will describe the sensation as a "slipping" or "pop" in the middle of the joint Frequently, when the click is not heard audibly it can be demonstrated by the stethoscope The click is usually best heard in the medial meniscus on external rotation and extension from the fully flexed position and in the lateral meniscus by internal rotation and extension There is no correlation between the degree of extension and the position of the

(8) Surg Gynec & Obst 77 87 90 July 1943

tear In 71 cases in which this test was made a part of the routine examination, it was found in 15 In each instance, a lesion was found in the posterior horn of the cartilage The entire cartilage should be removed routinely in all cases

TECHNIC—The short anterior medial or anterior lateral incision is the approach of choice It can easily be extended into the long parapatellar utility incision if associated pathologic changes are found in the joint There is no objection to the use of any of the specialized approaches by those who can uniformly make an exact diagnosis of isolated meniscal lesion

In regard to freeing the posterior portion of the meniscus, the knee is placed over the end of the operating table flexed to 90 degrees In the "relaxed" type of knee, the excision is usually done by dissection with knife and scissors with little difficulty Removal is facilitated by freeing the posterior attachment through the intercondylar notch so that the posterior rim of the meniscus is exposed when it is drawn to the side of the joint under moderate tension Gentleness is imperative throughout

If the knee is "tight" there are two alternate methods of freeing the posterior elements One is exposure through the Henderson incision This enters the posterior compartment between the hamstrings and the posterior aspect of the joint The second is the use of the tenotomy knife subcutaneously The knife is inserted at the posterior medial or lateral aspect of the joint ½ in above the articular surface of the tibia to insure that the blade will enter above the level of the meniscus With traction on the cartilage, the meniscus synovial junction is determined by placing the blade on the meniscus and moving it posteriorly until it drops in the soft synovial tissue The cartilage is separated from the synovia at this point and luxated into the intercondylar notch where it is amputated

The anterior medial incision is used in reoperation for posterior horn lesion, since in practically all cases another surgeon has performed the first operation Exact records are usually not available and associated pathologic lesions can be determined only by visualization in most instances

C H Cullen and G Q Chance[9] recommend *air arthrography to demonstrate lesions of the semilunar cartilages* It is simple and painless gives definite help

(9) Brit J Surg 30 41 45 January 1943

in diagnosis of difficult cases and increases the percentage of positive cases coming to operation

TECHNIC —The skin and capsule are infiltrated with novocain, *the suprapatellar pouch* is punctured ½ in above and lateral to the patella, any fluid present is aspirated and air is injected with a 20 cc syringe attached to the needle with a three way adaptor The air is filtered by covering the inlet with two or three layers of gauze swab The amount of air used varies from 70 to 140 cc injection being continued until the patient feels his knee definitely tight and there is enough tension to blow back slowly the piston of the syringe The needle is then withdrawn and the puncture sealed Air leaks through the puncture on withdrawing the needle are obviated by introducing the needle obliquely and maintaining firm pressure on the puncture site with a finger for two or three minutes The air is not aspirated after examination and does not seem to cause discomfort It is slowly absorbed in four to five days and allows time for further examinations if considered necessary

To insure that the air in the knee joint is under pressure a firm bandage is applied to the suprapatellar bursa starting from above The joint space is quickly screened and outlined *with skin pencil immediately after bandaging*

For accurate centering, a special cone 30 in long with an aperture 6 in wide is used The knee is arranged so that the central beam passes horizontally through the side of the knee in a glancing way, through the portion of the cartilage to be examined and through as little else as possible The part of the knee under examination is always upward to insure maximal air filling Unscreened films without grid and working at 36 in focal skin distance, and 200 ma /sec at 60 kv are used

Films were interpreted without clinical knowledge of the cases, and the opinion was checked by operative findings Roughly five types of findings were recognized separation of cartilage from lateral ligament separation of cartilage from tibia, fracture of cartilage, fracture of cartilage with displacement of fragment fragmentation reaching in some cases almost complete disappearance

The series reviewed consists of the authors' first 32 cases clinical diagnosis of which was definite cartilage

lesion, 12, doubtful cartilage lesion (probably positive), 5, doubtful cartilage lesion (probably negative), 5, no evidence of cartilage lesion, 10

Twenty two cases came to operation In only one that did not come to operation was a definite diagnosis of osteo arthritis made clinically and roentgenologically Definite diagnosis was impossible in the others the arthrogram was normal in four, inconclusive in four and suggested internal semilunar cartilage lesion in one These patients had a course of physical therapy, in none did the knee cause further trouble, and the subsequent course makes it likely that the diagnosis was correct

An air arthrogram showed definite lesions in 18 of the 22 patients whose knee joints were explored The other four were negative on roentgen examination, but the following lesions were found one external cartilage cyst (clinically obvious), one erosion medial condyle, one mobile external semilunar cartilage and hypertrophied infrapatellar pad, one small erosion medial condyle (on reconsidering this case, either a loose or pedunculated body was seen in the films)

Seventeen patients would have had operation on clinical grounds the remaining five in all of whom definite lesions were found at operation would probably have been rejected on these standards In one case the arthrogram showed displacement of the medial cartilage, but at operation this was not considered sufficiently severe to warrant removal

In the 10 clinically negative cases arthrography showed the cartilages normal in 4 In one there was evidence of cartilage injury, and despite negative clinical findings this man should have had his knee explored In the remaining five air arthrography indicated pathologic conditions and operation confirmed the roentgen findings

New operation for repair of cruciate ligaments of the knee is described by Fred H Albee[1] (New York City), who has used it in nine cases in which sufficient time has elapsed to evaluate the procedure The posterior ligament alone was ruptured in one case and the anterior ligament alone in five cases In three, both ligaments were gone, and the result was unsatisfactory because of limitation of motion in one In all other cases results as to stability and motion were good No patient was operated on who did not present marked anteroposterior laxity

The fundamental principle of treatment should be the same whether only one or both ligaments are involved, an attempt should be made to hold the head of the tibia firmly anterior in relation to the lower end of the femur, unless there is marked laxity in the opposite direction Therefore attachment of the new ligament should be relatively anterior on the lower end of the femur and posterior on the head of the tibia It should have a *tension equal to that of the normal ligaments* This excludes anchorage of either end to soft tissues, periosteum capsule etc Forward luxation of the tibial head is controlled by merely placing the hole in the tibia anteriorly to that in the femur

TECHNIC —An Esmarch bandage and tourniquet high on the thigh insure a bloodless field The joint is entered through the midline by a split patellar vertical incision which gives ample exposure with the least amount of trauma A drill hole, 3/8 in in diameter is made obliquely through the outer condyle of the femur from an anterior external point to a point in the intercondylar notch which is well anterior if it is desired to hold the head of the tibia forward on the femoral condyles and prevent its luxation backward If the opposite is the case this drill hole is placed more posteriorly A drill hole the same size is made through the outer anterior portion of the tibia to a point as near the insertion of the cruciate ligaments to the head of the tibia as possible or well posteriorly if the tibial head luxates back or anteriorly, or if it luxates forward The

(1) Am J Surg 60 349 35 June 1943

necessity of accurate determination of the amount and character of the motion of the tibial plateau upon the femoral condyles before operating cannot be too much stressed so as to place drill holes accordingly

An incision high up on the thigh of the same side at the anterior outer aspect lays bare the fascia lata from which the graft—7 in long and 1 1½ in wide, in the adult—is obtained With a small flexible probe through the eye of which is placed a silk loop this fascia lata is pulled through the drilled holes and the leg is straightened from its flexed position The fascial graft is firmly keyed into the tibial hole by a bone graft wedge obtained from the anterior interior broad surface of the tibia at its upper end the fascia lata at the femoral side is held tight by an assistant and a bone graft key is driven into the femoral hole, holding the fascia lata firm and under strong tension (Fig 259)

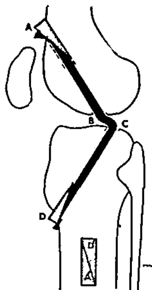


Fig 259 —General scheme of operation Black indicates fascia lata extending through drill holes into condyles of femur and head of tibia and traversing the joint at *B* Extreme tension at *B* and *C* is firmly held by bone graft keys at *A* and *D* which are obtained from head of tibia at *A* and *D*

Immobilization in a plaster of paris cast from the groin to the base of the toes with the knee in 5 to 10 degrees of flexion follows for two weeks, after which the knee is mobilized by physical therapy particular attention being directed to establishing motion and developing the quadriceps extension muscle

Advantages of the procedure are (1) It does not use for repair a tendon or any other structures which have to do with function of the limb (2) It disturbs to a minimum the periarticular structures and is the least possible traumatizing approach to the knee joint (3) The new ligament maintains its tension because of the bony anchorage when weight bearing and motion are allowed as early as two weeks after operation

To reduce an old standing dislocation of the knee joint, F P Fitzgerald[6] used a modification of the meth od devised by Hamilton Russell (1924) for treatment of fractures of the shaft of the femur skeletal traction was applied instead of strapping extension

Man, 56, had rheumatoid arthritis for years, was confined to bed for over 2 years and had dislocation of the right knee for about 18 months Under anesthesia, movement was about 10 degrees The hip was placed on an adjustable Braun splint so that traction could be exerted in the line of deformity (Fig 260) Skeletal traction was applied through the os calcis to

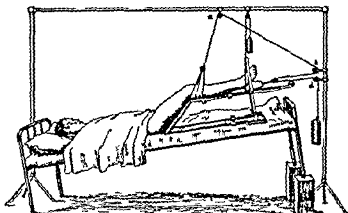


Fig 260—Traction under the knee pulls head of the tibia forward The cord attached to nail and passing over pulley *e* helps to rectify external rotation Adjustable splint has been flexed to fit contracted knee.

control external rotation A sling was passed under the knee and attached to a cord which passed over a pulley (*a*) on a Balkan beam, thence it was continued to another pulley (*b*) on the vertical limb of the beam at the level of the leg A third pulley was fixed to the Bohler stirrup on the os calcis nail (*c*) and a fourth (*d*) tied to the upright just below *b* The cord was then threaded over these and attached to a 7 lb weight The foot of the bed was elevated A cord was fixed from the outer side of the nail to a weight suspended by a pulley (*e*) on the horizontal limb of the Balkan beam to control external rotation

Three weeks later a roentgenogram showed that the disloca

(6) *Brit M J* 2 542 Nov 7 1942

tion was reduced During this time the patient did not complain of any undue discomfort As the knee was on the adjustable type of Braun splint, it was possible to lower its horizontal position and thus to extend the knee gradually By doing this and altering the line of pull accordingly, the limb could be straightened completely This took about seven weeks

Exposure of Arched Segment of Anterior Tibial Vessels—Records of bleeding from the arch are scarce enough to leave most surgeons unprepared to stop it by direct exposure Pierre Duval, to reach an aneurysm of the arch, divided and drew aside the upper third of the fibula, exposing the bone by cross cutting the outer head of the gastrocnemius and part of the soleus, after first liberating the external popliteal nerve and looping it safely out of the way But this measure is complex and Arnold K Henry[7] (Univ of Egypt) found a simpler solution



Fig 261 —Finding intermuscular plane for opening upper reach of the anterior compartment of the leg Thumb pressed up from below fits lengthwise into pointed arch between tibia and fibula Open skin and fascia along a line bisecting the thumb from nail to wrist Line marks where the curved plane of cleavage comes to the surface It does *not* mark course of anterior tibial bundle which here lies deep to the lateral muscle

PROCEDURE —He assumes that, with the patient prone, the first exploration is already made from the back—the reasonable quarter in which to seek control of an unknown source of bleeding in this region—and the objective has not been reached The vascular arch juts forward and is held fast in front Therefore he turns to the front of the leg to mobilize the arch in the anterior compartment Until now a sandbag under the instep has bent the knee and slackened the calf of the injured extremity Without altering the facedown posture of the

(7) Lancet 1 141 142 Jan 30 1943

patient, the foot is raised from the sandbag and its medial edge is put across the other ankle, a move that will allow exploration of the anterior compartment of the leg without losing full control of the posterior wound

The first step is to separate the two muscles that cover the *front of the vascular arch and its anterior tibial continuation*

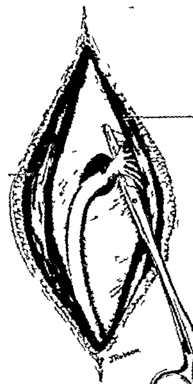


Fig 262 —Finding leash of arch for recurrent tibial vessels Pair of forceps slides up interosseous *membrane* medial to main neurovascular bundle and lifts leash for section A few small nerve twigs may run with it and can be spared they do not moor the arch If cut the *tibial anterior remains* well supplied Diagram shows arteries without veins or nerves

Between the two muscles the plane of cleavage is curved in cross section for the belly of extensor longus digitorum bulges into the adjoining belly of tibialis The line along which this curved plane comes to the surface is easily found The pulp of the thumb directed up from below is pressed and fitted into the pointed gothic archway *where tibia and fibula meet A cut is then made in* the skin of such length and direction as would bisect the guiding thumb and metacarpal from nail to wrist (Fig 261) The deep fascia is opened along the same line without tearing muscle A finger separates the interlock of the two bellies and reveals the anterior tibial vessels Covered by the long extensor they lie well to the fibular side of the cleavage plane on a background of interosseous membrane When they are thoroughly exposed in the whole length of the wound *the vascular arch is mobilized*

The arch is moored in front by its own recurrent tibial branch and venous tributaries The narrow proximal end of the leash is found and cut (Fig 262) Then if the hole in the interosseous membrane is large enough *the arch can at once be drawn back into the calf* If the hole is small and fibers of the posterior tibialis

clothe the membrane to a high level, the passage must first be enlarged by dividing the membrane down the tibial side of the vascular bundle (to avoid the nerve) and using a finger to stretch a path through the sheet of muscle When that is done the last impediment is removed and gentle traction brings the arch to view in the posterior wound

Leg—R Watson-Jone and W D Coltart[2] (M C, R A F) consider the causes of *slow union of fractures* and review 804 fractures of the shafts of tibia and femur Uncomplicated fractures treated by simple manipulation and plaster are uniting as quickly today as in former years Fractures of the tibia were never soundly united in six or seven weeks, they were only clinically united, and later yielding

Ten 12 weeks should be the minimal period of immobilization of lower limb shaft fractures lengthy protection not only is more safe but accelerates functional recovery Only the minimal period of immobilization can be fixed, the average period is meaningless because there is such wide variation between uncomplicated fractures which unite in about 12 weeks difficult fractures in 12 to 24 weeks infected and distracted fractures in 6 to 12 months and avascular fractures in 1 to 3 years

Interrupted immobilization, traction and distraction infection, persistent angulation too early weight bearing and loss of blood supply to the fragments cause delayed union but only when there is failure to prolong immobilization accordingly do they cause nonunion Every fracture unites if it is immobilized long enough

Greater use of skeletal traction accounts for recent increase in frequency of slow union particularly in fractures of the shaft of the tibia The time required for union is trebled or more than trebled by distraction, even if it amounts only to ¼ in and even if corrected in a few days Traction without obvious distraction also causes marked delay in fractures of the tibia

(2) Brit J Surg 30 60 76 January 1943

In skilled hands operative reduction does not cause delay, and it is better to prevent redisplacement of unstable fractures of the tibia by internal fixation than by continuous traction The decision to use internal fixation should be made within a day or two of injury, it should not be a last resort

Early weight bearing in plaster, skeletal transfixion apparatus or a caliper splint does not accelerate union, it delays it Delay is most striking if angulation of the fragments is imperfectly corrected, because weight bearing then causes distraction on one side of the fracture Weight bearing before the stage of clinical union is unwise

Reduction of fractures of the shaft of the femur should be secured immediately by manipulation and not gradually by heavy traction, light continuous traction should then be used only to maintain length and not also to control alinement

Time of immobilization of fracture of the femur should not be influenced by fear of knee joint stiffness Permanent stiffness is due not so much to prolonged immobilization of the joint as to anchorage of the quadriceps by the initial muscle injury, subsequent infection or low grade infection of pin tracks

Infection of fractures and of neighboring soft tissues causes serious delay and should be minimized by early wound excision, early sequestrectomy and early replacement of destroyed skin by grafting Infection of a fracture should not be a cause of nonunion

Charles N Pease[3] (Chicago) has used *beaded wires in closed reduction of fractures of the leg* in 19 cases 7 of which were compounded The beaded wire is a Kirschner wire to which a metal bead, $\frac{5}{32}$ in in diameter, has been brazed

TECHNIC —A plain Kirschner wire is drilled through the

(3) Surg Gynec & Obst 75 647 651 November 1942

os calcis A bow is applied and fastened to the foot piece of the fracture table and screw traction is used until the fragments can be gently manipulated into position

At the site of election a beaded wire is drilled into the bone A puncture wound must be made in the skin to admit the bead, but it is not necessary to make the incision deeper than the skin When the bead strikes the bone, it indicates satisfactory insertion With this wire as a landmark, the re

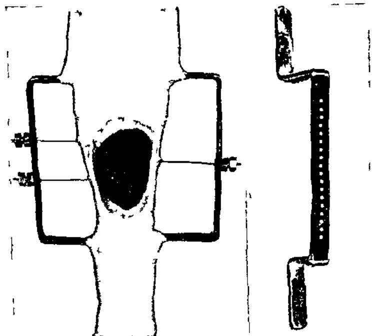


Fig 263 (left) —Cast with perforated U bar against which tautening bolts are so placed as to dispense with secondary wiring to bar
Fig 264 (right) —Perforated U bar

maining beaded wire or wires are introduced alternately in opposite directions A Kirschner bow with a Thomson attachment or the double transverse traction bow is then applied, and the fragments are brought together A long leg cast is applied and after it has set tautening bolts are fastened to the protruding wires to hold the beads firmly against the bone A washer or slotted metal piece may be placed between bolt and cast so that the latter will not become indented A long metal U shaped bar in which small holes have been drilled at

1/4 in intervals is incorporated in the cast for use in compound fractures (Figs 263 and 264) The wires are then directed through one of the holes and the tautening bolts are attached to the wires on the outside of the bar This makes counterpressure on the cast by the bolt unnecessary and allows removal of the plaster over the denuded area so that the wound may be dressed After reduction, roentgenograms are made for confirmation of position and correction if necessary A generous amount of padding of the cast is recommended to allow for possible swelling of the extremity

After recovery from the anesthetic, the patient may leave the hospital Weight bearing with crutches is permitted After five or six weeks the cast and wires are removed and a snug fitting cast is applied allowing full weight bearing as soon as the cast is dry A block of rubber or a ball of plaster is incorporated in the bottom of the cast to facilitate walking The plaster ball is recommended because it is harder than the rubber and gives a firmer impact with each step, thus giving more stimulus to new bone formation

Firm union was obtained in all cases In most instances the cast was removed after 12 weeks and in the remainder within 16 weeks

A case of *leg ulcers as a complication of caisson disease* is described by S Thomas Glasser[4] (New York City) This complication is not mentioned in the literature and must be considered exceptionally rare

The ulcers of about four years duration were preceded by the appearance of multiple bullae on both legs After a few days the blisters broke down, and the resulting ulcerations have persisted up till now Examination showed marked melanotic pigmentation of both lower extremities The absence of varicosities and swelling was noted The pedal popliteal and femoral pulses were readily palpable There were many small ulcers and several large ones on the lower one third of both legs The ulcers appeared indolent and were moderately demarcated and covered by fairly healthy granulations and a small amount of seropurulent discharge The edges

(4) Surgery 14 30 305 August 1943

were neither undermined nor indurated, and there was only little evidence of fibrosis at the bases The anterior thigh muscles were rigid on palpation, and the knees showed limitation of movement (about 50 per cent), evidently due to partial ankylosis

Treatment with wet dressings adhesive strapping and Unna boots provided no improvement Seed and Thiersch grafts were only about 50 per cent successful Although the ulcers were kept clean and bed rest was maintained, healing remained refractory After six months of treatment the patient was discharged to the outpatient department One year later, the ulcers were about the same as on discharge

Vicente Banet y Pina Pedro P Nobo Gelats and Juan Levy Boladeres[4] describe their experience with *certain aspects of surgery of the sympathetic nerve* They cite 15 cases of chronic ulcer of the leg in which lumbar ganglionectomy was successful This operation produces immediate permanent vasodilatation of the extremity with increase of the red and white blood cells in the general circulation the leukocytosis involves especially the neutrophils and the count returns to normal in three weeks to two months Bacteriologic studies have shown that with ganglionectomy the infected chronic ulcer becomes sterile in five to eight days In the mean time the increased circulatory activity changes the nutritional conditions of the connective tissue, which allow it to proliferate and repair the lesion

The authors also cite four cases of grave diabetes (three with gangrene of part of an extremity) in which resection of the splanchnic nerve was done by the extra peritoneal costo abdominal route of Legueu Fey This method should be reserved exclusively for patients with insulin resistant grave diabetes especially when it is associated with surgical complications The glycemic

(4) Rev de med y cir de Habana 47 995 20 July 31 194_

curve becomes stabilized after a phase of instability, during which hypoglycemic shocks are observed with much lower amounts of insulin than before operation Splanchnicectomy not only regulates the glycemia but, by its vasodilating action, also increases the leukocytosis, favors healing of the infectious focus and thus helps decrease the insulin resistance The efficacy of the intervention is shown by the greater tolerance of the diabetic patient for surgery Of the four practically hopeless cases, one was fatal and improvement occurred in three

Noninfective Gangrene Following Fractures of the Lower Leg—Charles G Child[8] (Cornell Univ) reviewed the 14 cases found in the literature and reports another case As average age is 26, degenerative diseases of the arterial wall can largely be discounted as a factor predisposing the vessels to injury and subsequent occlusion Degree of injury is considered severe in six, moderate in seven and mild in two

Site and extent of fracture do not seem to predispose to this complication In nine cases, gangrene involved the lower leg and foot, in five the foot alone, and in Child's case the lateral muscles of the calf only The popliteal artery was occluded in four both the anterior and posterior tibial in eight, the posterior tibial alone and the anterior tibial alone in one each In all probability the complication was not related to the method used for immobilization Anatomic relationships of the division of the popliteal artery into the anterior and posterior tibial arteries have been found to be the predisposing factors

In all but two cases amputation became imperative five through the thigh and eight through the lower leg The two exceptions were one case in which amputation was refused and the result was a useless leg and Child's case in which the foot functioned only partially even

(8) Ann Surg 116 721 728 November 1942

when supplemented by a brace There were no deaths

As gangrene is amenable only to amputation, the logical approach is early recognition of threatened gangrene and prompt treatment which might reasonably be expected to prevent its development Fractures of the lower leg should be particularly watched for evidence of failing arterial pulsation, progressive loss of sensation, coldness, increasing cyanosis and pain Should any one or any combination of signs appear, a progressive thrombotic process should be suspected Adequate heparinization should be considered for preventing further thrombosis A wide incision should be made in the vicinity of a large hematoma to relieve pressure and explore for an injured vessel If possible, such a vessel should be repaired by end to end suture and even perhaps by a free venous graft Some form of sympathetic block must be instituted, and the principle of "look and see" rather than "wait and see" must be applied Since in most cases there was an interval of 1 to 16 days before gangrene occurred, some warning of the imminence of the complication is given In Child's case, the gangrenous process probably did not start until the third day Had the serious nature of the complication been anticipated, it might have been avoided by institution of one or more of the measures outlined

W A Pryor[8] (Ballarat) shows that the *Thomas leg splint* can be used on fully dressed subjects for first aid purposes and transport of casualties The following materials are needed (1) A piece of stockinet is doubled over and stitched to form a sleeve which slips onto the splint to form a cradle for the injured leg The leg of a pair of long drawers does admirably (2) A piece of spring steel 3/4 in wide and 1/16 in thick, shaped like a bicycle clip with the ends turned in is drilled to take a piece of hard drawn wire 1/8 in in diameter and about

(8) M J Australia 2 166 Aug 9 1942

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(8) Ann Surg 116 7 1 7?8 November 1942

"patient (without a fracture) has been tossed about on a stretcher until his body left the canvas, but nothing was disturbed

For use without the boot or stout shoe, application is modified The spring clip is applied to the piece of wood to bring the line of extension to about the front of the heel, i e, in the line of the tibia The wood is then placed against the sole,

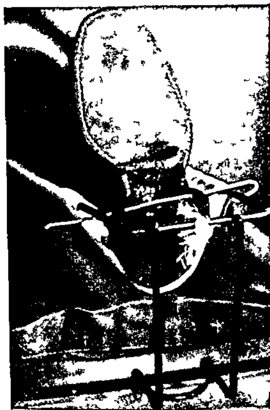


Fig 266 —View of attachment from below

where it is fixed with bandages extension being taken from the clip as before

The support shown (Figs 265 and 266) is for use with the military type stretcher with flat traverse bar, but the attachment can be varied to suit almost any shape It can also be used to prop the end of the splint if the patient is unloaded on a floor or bed from the stretcher

10 in long The ends of this wire are turned over to prevent their slipping out (3) A support for the end of the splint slips over the transverse bar of a military type stretcher Weight of the splint fixes it in position (4) A piece of cord or a triangular bandage is required to take extension from the spring clip to the end of the splint (5) For use without a boot, a flat piece of wood measuring about 10×3×½ in is required

METHOD—The stockinet is pulled part way on the Thomas splint before it is placed on the leg The ring is adjusted and



Fig 265—Lateral view of attachment

stockinet pulled up The spring clip is applied to the boot immediately in front of the heel the inturned ends going in between sole and upper While the foot is held to overcome eversion usually present the wire bar is slipped under the inner bar of the splint and left above the outer bar If this cannot be done easily, ends of the wire are tied to the side bars of the splint The spring clip tied to the end of the splint to take required extension will stand much greater strain than any required extension will cause The support is now slipped on the traverse bar of the stretcher, to take the end bar of the splint when the patient is placed on the stretcher Fixing appears to be unnecessary With the appliance in position a

ing sinuses, no swelling or tenderness, no pain either at rest or on weight bearing, normal gait, normal activities and bony fusion with healthy appearing bone in the final roentgenogram A result was good if it met all but one or two of these requirements, it was fair if the fusion was considered doubtful on x ray examination and a brace advisable, although symptoms were slight

On this basis, the end result in 16 of the cases was excellent, in 6 good and 3 fair Excellent and good results together make a total of 88 per cent satisfactory results The fair results in this group are better than amputation

Of nine cases with talocalcaneal joint involvement, re sults were excellent in four, good in four and fair in one Again the percentage of satisfactory results is 88 per cent

Arthrodesis is the treatment of choice for tuberculosis of the ankle and talocalcaneal joint regardless of age This procedure often gives an excellent clinical result, without evidence of disability In younger patients with extensive bone destruction or in poor general condition, a preliminary rest period of four to six months may be advisable The average period of disability when this form of treatment is used is much less than when a conservative regimen is followed Amputation is rarely, if ever, indicated in treatment of tuberculosis of the ankle

Francis M McKeever[5] (M C U S A) found that the literature on *fracture of the neck of the astragalus* reveals wide divergence of opinions concerning the in trinsic circulation in this bone, best method of treatment for this fracture and ultimate prognosis

Studies of the vascular system by injection suggest that the vital blood supply to the astragalus enters the neck through the superior astragaloscaphoid ligament

(5) Arch. Surg 46 720 735 May 1943

Ankle —*Sprains and Separations of Inferior Tibiofibular Joint without Important Fracture*—Tom Outland[9] (Harrisburg, Pa) finds that when no displacement can be produced under local anesthesia and the patient is able to walk, a zinc gelatin boot provides sufficient compression and support It is replaced at two week intervals until pain, swelling and tenderness have abated When subluxation can be detected, reduction and fixation in plaster of paris must be carried out to prevent the ligament healing in a relaxed condition

A nonpadded walking cast, after Bohler, has proved satisfactory Under local anesthesia, as much of the swelling as possible is removed by massage and kneading A U splint is smoothly applied to the lateral surface of the leg and ankle and bandaged with gauze As setting occurs marked pressure is exerted on the malleoli the thenar eminences of the hands being used to distribute the pressure over a considerable area A posterior plaster mold is then bandaged in place and the cast completed by a circular plaster bandage Next a walking iron is incorporated in the cast and weight bearing permitted The cast is allowed to remain from four to six weeks, when it is removed and a zinc gelatin boot applied until all tenderness and swelling have subsided

In chronic cases, radical treatment may be necessary to effect a cure A bone graft from the tibia of the same side stabilizes the distal tibiofibular joint This is driven into a drill hole in the tibia and fibula above the joint and has proved highly successful

Tuberculosis of the Ankle Joint—S Sverre Houkom[1] (Duluth) presents the end results in 25 cases in which the follow up period varied from 1½ to 13½ years, the average being 6⅔/10 years An end result was classified as excellent if it met the following criteria solid fusion in good position of 100 to 105 degrees dorsiflexion no drain

(9) Am J Surg 59 3 0 399 February 1943
(1) Surg Gynec & Obst 76 4 S 443 April 1943

surface of the tibia into the neck of the astragalus Thus the weight bearing thrust is placed on normal, undisturbed joint tissue and there is no tendency to subsequent lateral deformity of the foot The end result of the procedure should be a painless, normal looking foot and ankle with good stability and function

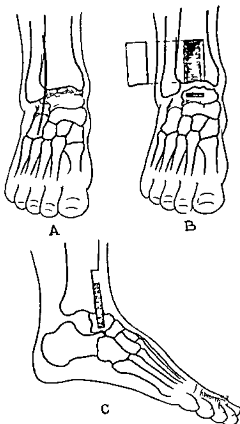


Fig 267 —Fusion operation for treatment of comminuted fractures and fracture-dislocations of body of astragalus. *A* anterolateral incision *B* sliding graft from distal anterior surface of tibia and quadrilateral hole gouged in neck of astragalus (sliding graft removed to permit better view of hole in astragalar neck) *C* sliding graft embedded in hole in astragalar neck Note space left by removal of astragalar body in *B* and *C*

Technic —A sliding graft, 1 in wide and 2 in long, is cut in the distal anterior portion of the tibia (Fig 267*B*) No cartilage is removed from the articular surface of the tibia except that which is attached to the distal end of the graft A quadrilateral hole is gouged in the neck of the astragalus (Fig 267*B*), about ¾ in deep and just large enough to accommodate snugly the end of the graft The foot is placed in 100 to 105 degrees of equinus and the graft is slipped down and embedded in the astragalar neck (Fig 267*C*) The lower end of the graft can be further secured by packing pieces of cancellous bone around it The upper end is held in place with sutures taken through the adjacent periosteum and the soft tissues over it The incision is closed and dressed and a cast is

End results in 17 cases show that only 4 were free from pain, had no restriction of motion in the ankle or the subastragalar joint and could carry on normal activity These four had sustained incomplete fracture of the neck of the astragalus without displacement Roentgenograms showed only a serrated line across the neck and all that was needed was immobilization

Attention is called to the high incidence of aseptic necrosis of the body, which leads to degenerative arthritis in both subastragalar and ankle joint and the severe disability which this produces

Complete removal and replacement of the body with all articular surfaces intact are condemned In a high percentage of cases of incomplete fracture the joints will recover without disability if protected Occasionally however aseptic necrosis of the astragalar body may result even under these circumstances Perfect anatomic reduction and maintenance of perfect position even when accomplished by simple manipulation will usually be followed by aseptic necrosis of the body and severe disability in the ankle and subastragalar joints Early erasure of the articular cartilage in the subastragalar joint may by removing the cartilaginous barrier to the ingrowth of blood vessels shorten the period for revascularization of the body and prevent extensive degeneration of the articular cartilage in the ankle joint

The customary treatment for *comminuted fractures and fracture dislocations of the body of the astragalus* has been astragalectomy or tarsal fusion but results have not been good Therefore Harry C Blair[2] (Univ of Oregon) suggests a simple operation for management of these injuries The principal steps are (1) exposure of the tibio astragalar joint by an anterolateral incision (2) removal of the fragmented astragalar body and (3) embedding of a sliding graft from the distal anterior

( ) Am J Surg 59 43 January 1943

Toes—The question has been raised *whether sesamoidectomy should be part of Hueter's operation for hallux valgus* The constantly good results which J Veyrassat and E Witzig[6] (Univ of Geneva) obtained with the Hueter technic show that in most cases complementary extirpation of the sesamoids is not indicated and would uselessly complicate operation It should not be forgotten that removal of the sesamoids, and especially of the internal one, may result in involuntary section of the short flexor of the big toe, with consequent formation of hammer toe However, sesamoidectomy is necessary for permanent cure in 1 to 2 per cent of the cases, according to the authors' experience

Another question is that of the advisability of systematic periarterial anesthesia of the posterior tibial to accelerate the healing process and prevent postoperative pain The authors' observations confirm the opinion of Leriche that the sympathetic may be a conducting path for pain and that the latter may be due to vasoconstriction It is not known why certain patients never have postoperative pain when they begin to walk, while others have Tissues traumatized by operation are sensitive especially when the entire weight of the body bears down on them, but it would seem that patients with postoperative pain must be in a condition of hypersympatheticotony, this condition has been demonstrated in some of the authors' cases Before giving periarterial infiltrations of novocain it is necessary to verify whether the pain is not caused by a bone sliver left in the joint as has been reported in some cases

Improved Operative Method to Obtain Bony Fusion of Great Toe—D H O'Donoghue and Richard Stauffer[4] (Oklahoma City) perform careful denudation of the cartilage surfaces of the interphalangeal joint with apposition of the raw bone surfaces While the toe is held in

(6) Schweiz med Wchnschr 73 38 ?41 Feb 20 1943
(4) Surg Gynec & Obst 76 498 500 April 1943

applied from the groin to the toes, with the knee in extension The cast is removed 10 15 days later, the skin stitches are taken out and a nonpadded walking cast is applied from the knee to the toes This cast is equipped with a walking iron, since the patient is encouraged to walk as soon as he is able to bear weight

Foot—Maurice A Walker[3] (Kansas City) used the following *treatment of nail puncture wounds of the feet* in 220 cases since 1937 No patient seen within 24 hours of injury has lost time except for the remainder of the shift on which he was working No infection of consequence or tetanus has developed

Technic—The patient is laid flat on a table with the foot elevated on a small pillow or block Rubbing alcohol is swabbed over the wound, which is usually sealed and looks insignificant With a double edged razor blade flexed between the thumb and the fingers to make a curved cutting edge, a circular patch of plantar callus about 1 in in diameter is removed, leaving thin pink skin around the nail hole At this depth there is a jagged opening containing bloody watery fluid and often dirt, sand or rust, depending on the condition and environment of the nail The remaining irregular edges of this wound can be trimmed with the razor blade or with cuticle scissors It has thus been converted from a sealed pocket covered by a plate of unyielding callus to an open wound surrounded by an area of soft thin skin Debris may be picked out of the wound with small forceps or washed out with soap and water or peroxide, using pledgets of cotton Alcohol is again applied and the wound protected by a small dry dressing The patient is advised to remove this dressing before going to work next day, by which time the wound is usually dry and almost healed and needs no further protection Antitetanic serum is administered to all patients

If the patient is seen soon after the injury, he is directed to cease work for the remainder of the day In all cases, after the wound is treated the patient is instructed to elevate his leg on two or three pillows, well above his body This position is maintained for 12 hours and repeated for 20 minute periods every 4 hours during the next few days if there should be any swelling or pain He is warned particularly against soaking the injured foot in hot water

(3) J Kansas M Soc 43 463 November 1942

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(6) Schweiz med. Wchnschr 73 238 241 Feb 20 1943
(4) Surg Gynec & Obst. 76 498 500 April 1943

satisfactory position, a Kirschner wire is drilled linearly through the end of the toe, traversing the distal phalanx, crossing the denuded joint and extending well into the proximal phalanx Ordinary closure is then carried out Since the Kirschner wire provides firm internal fixation, no external immobilization is necessary The most satis factory method of dealing with the end of the wire is to clip it off just outside the skin surface Weight bear ing is allowed as soon as the wound is healed, provided other conditions of the foot permit

Bony *fusion occurred in 85 per cent of the authors* patients The average time for leaving the wire in was 12 weeks A somewhat longer period would probably be desirable if there is no discomfort from the wire The 14 patients in this series had poliomyelitis and were sub jected to transplantation of the extensor hallucis ten don of the dorsum of the foot

In the *treatment of congenital hyperextension of the fifth toe,* F C Goodwin and F M Swisher[7] (Hot Springs N M) use the following technic which has been highly successful in all their patients including children and adults

TECHNIC —A Y shaped incision is made at the base of the toe on the dorsum of the foot The stem of the Y extends proximally over the extensor tendon, the crotch lies almost *directly over the metatarsophalangeal articulation, the* branches extend diagonally distalward about halfway around the toe The angle between the branches should not exceed 90 degrees and may be somewhat less

The incision is carried down to expose the extensor tendon which is then cut in the usual Z plasty manner for tendon lengthening The joint capsule is exposed and cut at least 180 degrees around the joint If the original deformity is mainly hyperextension, the capsulotomy is done mainly on the dorsum If there is marked adduction in the deformity, the capsulotomy must extend well down on the medial side of the joint

Now the toe should be freely movable and assume a normal

(7) J Bon & Jo t Surg 5 193 196 January 1943

position without forcing The toe is maintained in this position while the severed tendon is repaired, plenty of lengthening is allowed, so that the tendon is loose when the toe is in normal or slightly flexed position

The skin is closed, starting at the proximal end of the stem of the Y and allowing the triangular flap of the skin to slip distally as far as necessary before it is sutured into the incision After closure, the angle between the branches of the Y will be more obtuse and the incision will approach a T shape

Any adequate method of maintaining the position of the toe postoperatively may be used, but perhaps the best for 10 days or so is a short leg plaster of paris cast, with a minimum of padding over the area of the surgery and carefully molded in this area so as to maintain the desired position After the incision has healed and the stitches are taken out, the patient is taught to strap the toe down with adhesive and this strapping is continued for six weeks If desired, especially in adults, this type of fixation may be used immediately after surgery and no cast applied

The procedure may be carried out satisfactorily under local anesthesia

Varicose Veins—R W Postlethwait[8] (M C , U S A) emphasizes the importance of proper technic in *ligation of the saphenous vein for varicose veins*

Inadequate ligation is indicated by finding (1) a palpable dilated vein at the fossa ovalis (2) a positive result of the Trendelenburg test (3) emptying of the dilated veins when the patient walks with a tourniquet at the fossa ovalis (4) a small cutaneous incision and (5) an intact saphenous vein or dilated tributary at operation If these evidences are present only the saphenous vein or a large tributary mistaken for it was ligated at the first operation

Great variation in the size number and location of the tributaries is known to occur Therefore, three requirements must be fulfilled for complete ligation (1) the great saphenous vein must be ligated close to the femoral vein, (2) a segment of vein at least 5 cm

(8) Arch Surg 47 4 7 July 1943

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Now the toe should be freely movable and assume a normal

(7) J Bon & Joint Surg • 193 196 January 1943

can be adequately controlled by usual analgesics aspirin, phenacetin or small doses of codeine

TECHNIC—With the patient sitting on the table and the lower extremities on a nearby stool or simply flexed over the side one of the most distal varicose veins, usually around the ankle, is selected A 25 gage needle, attached to a syringe containing 3 5 cc of sclerosing solution, is inserted into the vein at the most convenient distal point With the syringe held firmly in place but without injecting any of the sclerosant, the patient's lower extremities are brought carefully onto the table, the patient lies horizontally, and the involved extremity is elevated by an assistant to at least 45 degrees with the horizontal As much as possible of the blood contained in the veins is permitted to drain into the deep system and, when the extremity appears pale, the sclerosant is injected into the ankle vein and the needle removed No bleeding occurs from the needle puncture since the point of injection is above the level of venous pressure A small dry dressing is placed over the puncture site and an elastic bandage wrapped from the ankle to the middle of the thigh The extremity is then placed on several pillows and the patient allowed to remain in that position for 20 minutes, following which he is ambulatory Walking about after this period has been stressed as a prophylactic against embolism

Any of the popular sclerosants may be used, such as mono ethanolamine oleate (monolate), 5 per cent sodium psylliate (sylnasol) or quinine hydrochloride and urethane

W W Heyerdale, O T Clagett and E M Anderson[5] recently treated four patients with *acute superficial thrombophlebitis in an incompetent venous system of the lower extremities* They designate as acute superficial thrombophlebitis recent thrombophlebitis involving the superficial veins which had occurred prior to the patient's registration at the clinic In none of the cases were the veins in the entire extremity involved, nor was there edema of any degree except in the immediate region of the involved vein The patients' symptoms were limited to mild febrile reaction, dull pain, tender

(5) Proc Staff Meet. Mayo Clin 18 1 4 Jan 13 1943

long must be removed, and (3) all tributaries in this segment must be ligated separately

PROCEDURE.—Under local anesthesia, an oblique incision, 4 5 cm long, is made parallel with and 3 cm below Poupart's ligament and with its lateral end over the femoral pulsation, it is carried down through the superficial fascia The great saphenous vein is found above the superficial layer of the deep fascia and usually in the medial half of the incision, it is isolated and divided between clamps The dissection is carried superiorly to the saphenofemoral junction, each tributary being isolated, divided and ligated The saphenous vein is ligated as close as possible to the femoral vein, first with a single silk ligature and then with a transfixion suture of the same material The portion of the vein distal to the ligature is excised The dissection is then carried inferiorly, and by upward traction on the vein and downward traction on the edge of the wound a total of 5 to 8 cm of vein is excised A single ligature is placed about the inferior end of the vein The superficial fascia and skin are closed with interrupted sutures of fine silk and a firm dressing is applied

The patient is urged to walk as soon as possible after the operation and, if necessary, is helped to walk before six hours have elapsed Walking is then required every seven hours

Retrograde injection of sclerosing solution at the time of operation is inadvisable, because adequate thrombosis of the long saphenous system will occur occasionally after operation without injection, leakage of the solution into the wound may result in unsatisfactory healing and the resulting reaction in a patient sensitive to the sclerosing solution may cause prolonged incapacity

Carroll J Bellis and Otto L Churney[9] (M C, U S A) recommend *injection of varicose veins with the extremity elevated* so that the sclerosant is introduced into relatively bloodless vessels With this method it has usually been possible to produce thrombosis of the entire varicose system by a single injection There is an appreciably greater periphlebitis, parallel to the greater venous length which is inflamed and thrombosed Pain

(9) Surgery 13 411 415 March 1943

veins This suggests that the various cutaneous lesions associated with varicosities do not have their origin in a diminished arterial inflow

Howard Mahorner[7] (Tulane Univ) obtains *venograms of the extremities* by a method which obviates cutting down on the vein

TECHNIC —With the patient sitting on the roentgen table and the legs dependent, a 20 gage needle is inserted into a

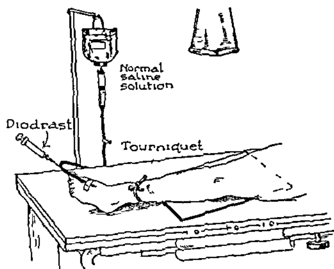


Fig 268 —Method of shunting contrast medium from superficial into deep venous system by use of tourniquet around leg

vein on the dorsum of the foot or on the ankle, one of the tributaries of the internal saphenous system The tubing of an infusion set containing normal salt solution is connected with the needle infusion is relatively rapid The needle is strapped in position with adhesive tape and the patient rotates and lies down on the table A large cassette containing the films is placed behind the calf and thigh (Fig 268) and the leg is slightly rotated outward A rubber tourniquet is applied round the leg usually at the junction of the middle and lower thirds tightly enough to impede circulation in the superficial veins This serves to shunt the infusion from the superficial into the

(7) Surg Gynec & Obst 6 41 49 January 1943

ness, redness and a sensation of stiffness in the involved portion of the extremity Heretofore, most patients having such symptoms would have been advised to go to bed, elevate the part and have warm, moist compresses applied for a number of days or weeks This treatment usually would result in a prolonged period of disability with accompanying economic loss

In place of such therapy, the authors divided and ligated the greater saphenous vein at the saphenofemoral junction and injected a sclerosing solution into the distal segment The agent most commonly used was a 5 per cent solution of sodium morrhuate in amounts varying from 0 5 to 3 cc, according to the height of the thrombophlebitis in the greater saphenous system Activity of sodium morrhuate is increased in thrombophlebitis Consequently less sclerosing solution is needed than in uncomplicated varicose veins Warm, moist packs may be applied to the involved extremity postoperatively for the patient's comfort The patient is dismissed a day or two after ligation and returns for further sclerosing therapy to eliminate the remaining patent varicosed veins as in the ordinary treatment of varicose veins

With this method the duration of the acute stage of the disease is shortened the varicosities which require ultimate treatment are obliterated simultaneously, there is less possibility of recurrence of the phlebitis, and the likelihood of development of pulmonary emboli from the thrombosed portion is reduced

David I Abramson and Sidney M Fierst[6] (Cincinnati) investigated the *peripheral circulation in varicose extremities* of 14 patients by the venous occlusion plethysmographic method Rate of blood flow was found to fall within the range of that for normal subjects or somewhat beyond it In no instance was decreased peripheral circulation observed in the extremity with varicose

(6) Arch Surg 45 964 968 December 194

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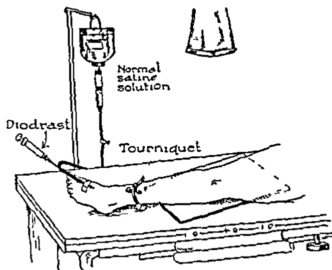


Fig 268—Method of shunting contrast medium from superficial into deep venous system by use of tourniquet around leg

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deep system Twenty cc of 35 per cent diodrast is slowly injected into the tubing of the infusion set just above the needle Five seconds after the diodrast is completely delivered, the technician makes the exposure (Figs 269 and 270) Then the infusion continues to run for 200 cc to wash the diodrast from

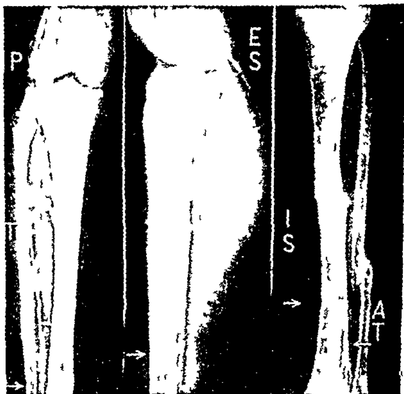


Fig 269 (left and center) —Anteroposterior and lateral films of right leg with veins visualized by diodrast Needle was inserted into a vein on dorsum of foot and a tourniquet (arrow) at junction of middle and lower thirds of the leg shunted blood into the deep system Venous system is adequately exposed showing posterior and anterior tibial veins and their juncture above the interosseous membrane to form the popliteal Several valves are disclosed Venous system looks normal *ES* external saphenous vein

Fig 270 (right) —Same case Left leg had long-standing edema from obstruction of deep venous system after fracture of femur six years before *Arrow indicates tourniquet at junction of middle and lower thirds of the leg* Diodrast seen in superficial system below and above the tourniquet and in some veins of the deep system below it although it has forced its way up the superficial system and is seen in the internal saphenous vein (*IS*) of the thigh no deep veins are visualized A control venogram of the right leg (Fig 269) which was normal showed visualization of the deep veins under the same circumstances Tourniquet at juncture of middle and lower thirds shunted contrast medium into the deep system *AT* anterior tibial

the veins. It is then possible to rotate the leg for a lateral or oblique view, or a plate may be placed higher under the thigh and the femoral veins exposed

A word of caution should be expressed concerning venography More extensive thrombosis and even death have been reported as complications

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